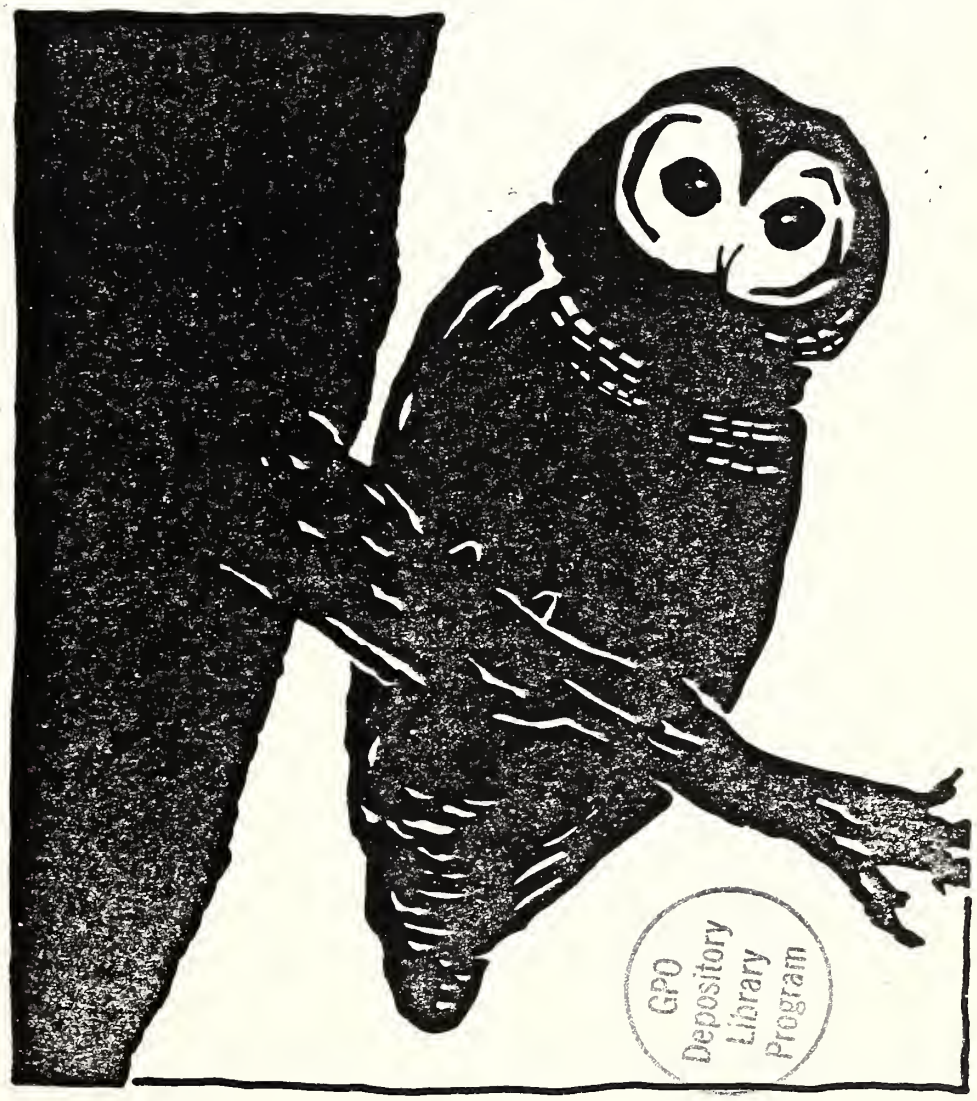
Draft Supplement

to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide

Volume 1

Spotted Owl Guidelines



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Dear Reviewer:

Enclosed for your review is the Draft Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide (SEIS).

The SEIS assesses the environmental consequences of proposed updated Regional standards and guidelines for the management of habitat for the northern spotted owl. Twelve alternatives covering a wide range of management options for the northern spotted owl habitat are evaluated. The Forest Service preferred alternative is Alternative F.

Beginning on August 15, 1986, you will have 90 days in which to review the SEIS and provide the Forest Service with your written comments. At the end of the review period, all public comments will be analyzed and the results used to prepare the Final Supplement. Your written comments will be important in helping me decide what will be the final decision.

Many of the 13 National Forests in the Pacific Northwest Region will scheduled open houses during the review period. These open houses will be informational meetings where you will be able to ask specific questions about the proposed standards and guidelines. The dates and places of these open houses will be advertised in the local news media.

The public review and comment period ends November 17, 1986. Your written comments must be received by that date to be included in the Final Supplement. Comments should be sent to the following address:

Regional Forester
Pacific Northwest Region
USDA Forest Service
319 SW Pine, Box 3623
Portland, Oregon 97208

Sincerely,

R. MAX PETERSON
Chief

DRAFT SUPPLEMENT TO THE FINAL

ENVIRONMENTAL IMPACT STATEMENT

FOR AN AMMENDMENT TO

THE PACIFIC NORTHWEST REGIONAL GUIDE

July 1986

Covering Forest Service programs that affect the States of Oregon, Washington, and portions of California .

Responsible Agency:

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Abstract: This Draft Supplement to the Final Environmental Impact Statement for an amendment to the Pacific Northwest Regional Guide assesses the environmental consequences of proposed updated Regional standards and guidelines for the management of habitat for the northern spotted owl, as well as alternatives to this proposed action. Each Forest Service Region is required by the implementing regulations for the National Forest Management Act to develop standards and guidelines for addressing major issues and management concerns which need to be addressed at the Regional level (36 CFR 219.8a). Standards and guidelines for northern spotted owl habitat management, was determined to be a major regional issue. At the direction of Deputy Assistant Secretary of Agriculture, this Draft Supplement proposes updated standards and guidelines for northern spotted owl habitat using additional research and scientific findings developed since the Regional guide and Final Environmental Impact Statement were written. The alternative adopted as a result af this supplement will serve as an amendment to the Regional Guide, to supercede the paragraphs on pages 3-12, 3-13, 3-14, and 3-15 under the heading titled Northern Spotted Owl Habitat Management. The standards and guidelines adopted will ensure the maintenance of a viable population of northern spotted owls. (36 CFR 219.19).

Preface

The regulations implementing the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA), require the preparation of a Regional Guide and an Environmental Impact Statement for the nine Regions of the National Forest System. The Final Environmental Impact Statement (EIS) was prepared in the format established in the Council on Environmental Quality (CEQ) regulations (40 CFR 1502.10); and the Final EIS and the Regional Guide were treated as combined documents (40 CFR 1506.4).

DRAFT SUPPLEMENT
TO THE ENVIRONMENTAL IMPACT STATEMENT
FOR AN AMENDMENT TO THE PACIFIC NORTHWEST REGIONAL GUIDE

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SUMMARY OF DRAFT SUPPLEMENT TO THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR AN AMMENDMENT TO THE PACIFIC NORTHWEST REGIONAL GUIDE

OVERVIEW

This document is a draft supplement to the Final Environmental Impact Statement for the Pacific Northwest Regional Guide (FEIS), USDA Forest Service, dated May 1984. The standards and guidelines determined through this process will be used to develop the ten to 15 year Forest Land and Resource Management Plans for National Forests in the Pacific Northwest Region. The supplement examines a broad range of alternatives for the management of northern spotted owl habitat on the following 13 National Forests: Deschutes, Gifford Pinchot, Mt. Baker-Snoqualmie, Mt. Hood, Okanogan, Olympic, Rogue River, Siskiyou, Siuslaw, Umpqua, Wenatchee, Willamette and Winema. The supplement summarizes currently available information on the northern spotted owl, describes the environmental relationships between the spotted owl and other resource, economic and social factors, and discusses the potential consequences of implementing either the proposed action or other alternatives.

INTRODUCTION

The northern spotted owl became a regional concern in the early 1970's when an interagency committee, called the Oregon Endangered Species Task Force, began to develop guidelines for management of northern spotted owls. The primary concern was for that portion of the Pacific Northwest in which there was a substantial decline in habitat thought to be important to the survival of the spotted owl.

Continuing into the mid-1980's, cooperation among government agencies, private groups and individuals continued as concern intensified over the fate of the spotted owl. The amount of biological information on the spotted owl also increased.

In May 1984, the Final Regional Guide and accompanying Final Environmental Impact Statement for the Pacific Northwest Region were published. These documents listed standards and guidelines for spotted owl habitat management and directed the consideration of such management in the National Forest planning process. Interim direction for managing spotted owl habitat until the National Forest plans were approved was also in the Regional Guide.

On October 22, 1984, the National Wildlife Federation, the Oregon Wildlife Federation, the Lane County Audubon Society, and the Oregon Natural Resources Council appealed the decision of the Chief of the Forest Service

concerning the treatment of the northern spotted owl in the Regional Guide. The Chief's decision, as it related to spotted owls, was reversed by the Deputy Assistant Secretary of Agriculture. The Regional Guide and accompanying Environmental Impact Statement were remanded to the Regional Forester for preparation of a supplement. The purpose was to more adequately consider the issues associated with spotted owl management and the recent biological information (March 8, 1985, letter from Deputy Assistant Secretary for Natural Resources and Environment).

This Supplement examines 12 alternatives for management of northern spotted owl habitat within the Pacific Northwest Region of the U.S. Department of Agriculture, Forest Service. These alternatives encompass a wide range of possible standards and guidelines as well as the general regional effects of implementing these standards and guidelines. They represent alternative approaches for achieving the goal of maintaining viable populations of the northern spotted owl. Each of these alternative approaches has its own circumstances of risks to spotted owl viability, potential impacts on other resource uses, and other characteristics. Because there is often incomplete scientific information and practical experience, standards and guidelines often have significant components of risk and uncertainty. Standards and guidelines are not scientific absolutes; they are based on judgment and their level can be set higher or lower depending upon the amount of risk that is reasonable and acceptable as well as the extent to which risk and uncertainty are reduced by the means selected for implementation (e.g., by increasing the intensity of monitoring during plan implementation or funding a high level of research during the ten to 15 year plan period, or both). Results of monitoring and research may be used to adjust management actions in the future, as long as resource options are still available.

The alternatives vary in their emphasis on the benefits produced and cover a wide range of possibilities for managing spotted owl habitat within the Pacific Northwest Region. The standards and guidelines associated with these alternatives do not specify land uses, nor do they specify actions to be taken on any specific land area in the Region. Rather they guide the decisions that are made in individual National Forest Plans regarding what actions are to be taken concerning a specific area. The guidelines will be used by individual National Forests to assure viability of northern spotted owl on a regional basis. The more site-specific consequences of these guidelines will be analyzed in development of the National Forest Plans.

It is important to remember that this Supplement in its present form is a draft document. Both the Supplement and that portion of the Regional Guide related to northern spotted owls are subject to revision based on the comments received during the review period. The review period is 90 days from publication of the draft supplement. The public will be able to contribute to the final selection of an alternative management strategy by submitting information for consideration. In addition, each person will be able to use the Supplement to determine which alternative best meets their preferences. Interested individuals and organizations are encouraged to comment on the findings of this Supplement for consideration in preparation of the Final Decision.

Federal and state agencies and private organizations have raised a number of issues concerned with managing spotted owl habitat. During the process of public involvement and scoping the issues to be examined in the Supplement, six national and regional public issues and management concerns were identified. These issues and concerns are:

1. The effects of timber harvesting on spotted owl viability;

2. The fact that decisions had been based on incomplete biological information and uncertain assumptions concerning the spotted owl;

3. The consideration of a worst-case situation;

4. The economic and social effects of protecting spotted owl habitat;

5. The effects on other resources of protecting spotted owl habitat; and

6. Disagreement about the habitat requirements of the spotted owl.

These issues and concerns formed the basis for identifying and analyzing the alternatives set forth in this document.

AFFECTED ENVIRONMENT

Physical and Biological Setting

The area that is affected by spotted owl habitat management consists of forest lands located from the Pacific Coast to the Cascade Mountain Range. These include some portions immediately east of the Cascade Crest. The area reaches from the United States-Canadian border to northern California.

Of the 19 National Forests within the Pacific Northwest Region, 13 are within the range of the northern spotted owl (Strix occidentalis caurina). The total forested area on these 13 National Forests is 13.7 million acres, of which 2.5 million acres are on lands withdrawn from timber harvest and 1.8 million acres are technically unsuitable for timber production. This leaves approximately 9.5 million acres available for timber production.

On National Forest lands, approximately 3.6 million acres currently provide suitable northern spotted owl habitat. Sixty-eight percent, or 2.5 million acres, of this habitat coincides with lands also considered tentatively suitable for timber production. The remaining 1.1 million acres of suitable owl habitat are located in areas unsuitable for timber production or are reserved for other purposes, such as wilderness.

The spotted owl is a medium-sized, nocturnal bird that inhabits the mountainous, forested regions of the West. Three subspecies have been described. The concern of this Supplement is the northern spotted owl subspecies. It is a round-faced, black-eyed bird without ear tufts. The northern spotted owl lives in the dense, mature and old-growth forests, most often dominated by Douglas-fir. Mature and old-growth forests have

the structural characteristics and type of vegetation that best provide the spotted owl with food, cover, nest sites, and protection from predation. Studies of spotted owl pairs indicated that the average size of a home range is 6614 acres in Oregon and 8585 acres in Washington. The amount of old-growth within these home ranges averaged 2264 acres in Oregon and 4202 in Washington. The current estimate of the population of the northern spotted owl is about 2800 pairs. This figure includes Federal, state, and private land in Washington, Oregon, and northern California.

Spotted Owl Viability

The implementing regulations for the National Forest Management Act of 1976, require the Forest Service to plan the management of wildlife habitats to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." A viable population, as defined in the regulations (36 CFR 219.19), is "one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area."

Viability of any species is best expressed as a relative term, rather than an absolute one. This is because species and their environments are always subject to change. This dynamic situation does not allow a 100 percent assurance that any species will exist indefinitely. Further, there is no single, fixed size of a population above which a species is viable and below which it will become extinct.

The assessment of the viability for the northern spotted owl population within the Pacific Northwest Region was based on a synthesis of existing data and the use of several analysis techniques. Steps in the analysis included:

1. Predictions of the amount and distribution of suitable habitat over time;

2. Estimates of the ability of habitat to support breeding pairs of owls; and

3. Analysis of genetic and demographic risks to the owls.

The purpose of the analysis was to understand the implications of alternatives on northern spotted owls for this planning period (ten to 15 years) and further to assess the likelihood that owl populations would persist up to specified periods in the future. It should be recognized that changes in management will occur based on monitoring and research.

The total habitat available for the northern spotted owl has been declining and will continue to decline as mature and old-growth forest stands are harvested. As the amount of habitat declines, it also becomes more fragmented, making it more difficult for owls to move from one patch of habitat to another. This increases the risk that one part of the owl population will become isolated from another.

The decline in the amount of habitat and the increase in fragmentation make the owl more vulnerable to other threats to viability. Three major categories of these potential threats to spotted owls were analyzed. These catgories were:

1. The variability of birth and death rates through time.

2. Loss of genetic variation.

3. Random catastrophes.

Social and Economic Characteristics

Wood products are especially important to all levels of the regional economy. Approximately 44 percent of Oregon's economy and 28 percent of Washington's economy are directly dependent on National Forest resources. The recession in the early 1980's demonstrated that employment in the Pacific Northwest and the demand for wood products are closely related. Unemployment sharply rose during this period.

Several communities in western Oregon and Washington are especially dependent on the wood products industry as a major source of employment and income. Factors affecting the future of these communities include changes in timber supply, technological changes within the industry, and changes in the demand for lumber. The availability of old-growth timber is one component of the timber-supply issue. This availability of old growth will be in part influenced by decisions as to how much habitat will be provided for spotted owls.

ALTERNATIVES, INCLUDING PROPOSED ACTION

Terms Used in the Description of the Alternatives

Suitable Habitat. This is habitat most often used by the northern spotted owl. It consists of stands of old growth or mature trees. The forest-types include the following species: Douglas-fir, western hemlock, western redcedar, silver fir, mountain hemlock, and ponderosa pine. The particuliar species or group of species constituting habitat for owls in a given location varies from south to north, east or west side of the Cascades, and elevation.

Capable Habitat. This is a stand of trees of a forest-type preferred by spotted owls, that is younger than mature and is capable of growing into suitable habitat in the future.

Tentatively Suitable for Timber Harvest. This is land that is outside of reserved areas and on which it is technically appropriate to manage and harvest timber.

Reserved Areas. These are lands withdrawn from timber harvest because of laws and regulations. They include wildernesses, natural research areas, and special interest areas.

Mature. Mature stands consist of trees at the age where growth is decreasing and decay is beginning.

Old Growth. Old-growth stands consist of trees that are mature and older than mature. These stands have particular characteristics including the presence of down logs, trees of various heights, and dead and dying trees.

The main differences among alternatives are the sizes and numbers of habitat areas specifically designated for spotted owls. The number of acres of suitable northern spotted owl habitat on reserved lands and lands not suitable for timber production is 1.1 million acres. These acres have the capability to support an estimated 229 potential pairs of spotted owls. In addition, 375,000 of these acres are in scattered stands and are considered unable to support spotted owls. Many of these acres are, however, included in designated habitat areas. The 229 potential pairs, as well as the capability of other Federal lands to support owl pairs, were treated as constant across all alternatives for the purposes of the spotted owl viability analysis. Capability of other Federal lands used in the viability analysis was based on areas designated to be managed for spotted owls on BLM lands in Oregon and Washington and National Forests in northern California and all habitat in National Parks within the range of the spotted owl in Oregon and Washington. Table S-1 displays these capabilities.

The expected persistence of spotted owls in the planning area at future dates under each alternative reflects the knowledge and assumptions used in this analysis (Table S-4). If knowledge or assumptions used are found to be too optimistic relative to owl habitat needs or demographics, the projected probabilities of persistence may be one or two categories lower. On the other hand, if the assumptions used are found to be overly pessimistic, the projected probabilities of persistence may be one or two categories higher. Monitoring together with research and development will provide the means for revising knowledge and planning assumptions.

Table S-1

Capability to Support Pairs of Northern Spotted Owls
on Reserved Lands and Lands Not Suitable for Timber Production
on National Forests in the Pacific Northwest Region and on Other Federal Lands that Have Been Designated for Management of Northern Spotted Owls in Washington, Oregon, and Northern California

Agency	State	Pairs of Owls
National Park Service	Oregon and Washington	61
Bureau of Land Management	Oregon	56
USDA Forest Service	California	195
USDA Forest Service	Oregon and Washington	229
Total		541

Alternatives Considered in Detail

Alternative A: Provide no formal measures to protect the spotted owl. Under this alternative, the Forest Service would make no special land use designations for specifically managing northern spotted owl habitat. Spotted owl habitat would be retained for the long term on 1.1 million acres of National Forest land in the Pacific Northwest Region. These acres will provide for 229 potential pairs. These acres are either in a reserved category, such as wilderness, or have been determined to be not suitable for timber production for technical reasons. On those lands tentatively suitable for timber production there would be 2.1 million acres of suitable owl habitat remaining by 1995.

Alternative B: Provide habitat areas for spotted owls located in areas not suitable for timber production and provide dispersal habitats in a stepping-stone fashion to link these areas. Under this alternative, the Forest Service would attempt to avoid isolating populations of spotted owls by providing islands of suitable owl habitat that could connect the populations and facilitate dispersal. These islands would each consist of 300 acres of mature and old-growth forest, spaced no more than six miles apart. Designated spotted owl habitat in areas tentatively suitable for timber production is 24,897 acres.

Alternative C: Provide 417 habitat areas for spotted owls with each habitat at least 300 acres in size. This is the current direction for management of spotted owl habitat in the National Forests of the Pacific Northwest Region. To the extent possible, each 300 acre habitat area should be one contiguous stand of mature or old-growth forest. In the original placement of these areas, 104 were located in lands not suitable for timber production. Designated spotted owl habitat in areas tentatively suitable for timber production is 77,343 acres.

Alternative D: Provide 550 habitat areas for spotted owls with each habitat area containing 1000 acres. This is the planning direction under the current Regional Guide for those 13 National Forests in the Region with spotted owls. To the extent possible, each 1000 acre habitat area should be one contiguous stand of mature or old-growth forest. In the inital design of this alternative, 158 habitat areas were designated in lands not suitable for timber production. Designated spotted owl habitat in areas tentatively suitable for timber production is 313,839 acres.

Alternative E: Provide 810 habitat areas for spotted owls with each habitat area containing 1000 acres. To the extent possible, each 1000 acre habitat area should be one contiguous stand of old-growth forest. Designated habitat in areas tentatively suitable for timber production is 509,779 acres.

Alternative F: Provide at least 550 spotted owl habitat areas with a variable amount of suitable habitat. This is the preferred alternative. The intent is to protect options for up to 2200 acres of suitable habitat per pair of owls, while minimizing effects on timber production during the first planning period. This will be done by removing 1000 acres from the land suitable for timber production for each designated habitat area

presently located on those lands and not scheduling timber sales on an additional 1200 acres. Designated habitat in areas tentatively suitable for timber production is between 313,837 and 690,446 acres.

Alternative G: Provide 550 habitat areas for spotted owls with habitat areas averaging 2200 acres. To the extent possible, each habitat area should be one contiguous stand of mature or old-growth forest. Designated habitat in areas tentatively suitable for timber production is 690,446 acres.

Alternative H: Provide 620 habitat areas for spotted owls with habitat areas averaging 2200 acres in Oregon and 4200 acres in Washington. To the extent possible, each habitat area should consist of mature and old-growth forest. Designated habitat in areas tentatively suitable for timber production is 948,246 acres.

Alternative I: Provide 797 habitat areas for spotted owls in clusters of three areas each. Each cluster of three habitats will be 6600 acres. To the extent possible, each habitat area should be one contiguous stand of old-growth forest. The clusters should be no more than 12 miles apart. Designated habitat in areas tentatively suitable for timber production is 1,120,306 acres.

Alternative J: Provide 1000 habitat areas for spotted owls with habitat areas averaging 2200 acres. To the extent possible, each area habitat should one be contiguous stand of mature or old-growth forest. Designated habitat in areas tentatively suitable for timber production is 1,390,366 acres.

Alternative K: Provide 1000 habitat areas for spotted owls with habitat areas averaging 2900 acres. To the extent possible, each habitat area should consist of mature and old-growth forest. Designated habitat in areas tentatively suitable for timber production is 1,837,211 acres.

Alternative L: Provide for no further reduction in spotted owl habitat and, in addition, select areas capable of growing into a suitable habitat condition. Under this alternative, approximately 200,000 acres of capable habitat would eventually become suitable. This alternative would improve the distribution of owl habitat on the National Forests of the Pacific Northwest Region compared to the present situation. Designated habitat in areas tentatively suitable for timber production is 2,618,125 acres.

The following table (Table S-2) summarizes the alternatives according to the following:

1. The total habitat acres required per alternative.

2. The size of designated habitat areas.

3. The average distance between designated habitat areas.

4. The number of designated habitat areas in each alternative.

5. The amount of owl habitat located on lands suitable for timber production in each alternative.

Table S-2

Features of Each Alternative
For Pacific Northwest Region National Forests

Alt.	Total Owl Habitat (acres)	Owl Habitat Area Size (acres)	Distance Between Areas (miles)	No. Designated Habitat Areas (each)	Habitat In Suit. Timber (acres)
A	1,100,000	--	--	--	--
B	1,124,897	300	6-12	102	24,897
C*	1,177,343	300	6-12	417	77,343
D	1,413,839	1000	6-12	550	313,839
E	1,609,779	1000	6-12	810	509,779
F**	1,413,839-1,790,446	1000-2200	6-12	550	313,839-690,446
G	1,790,446	2200	6-12	550	690,446
H	2,048,246	2200-OR 4200-WA	6-12	620	948,246
I	2,220,306	6600	4-12	797	1,120,306
J	2,490,366	2200	3-12	1000	1,390,366
K	2,937,211	2900	3-12	1000	1,837,211
L	3,718,125	--	--	1220	2,618,125

*No Action Alternative **Preferred Alternative

ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

Northern Spotted Owl Viability

There are currently estimated to be 2500 sites that could be occupied by pairs of northern spotted owls on Federal, state, tribal and private lands in Oregon, Washington, and northern California. The number of these sites actually occupied by pairs of owls is unknown. It is estimated that National Forests in the Pacific Northwest Region can currently support approximately 1250 pairs of northern spotted owls.

The viability analysis projects that enough habitat will remain on these National Forests after 50 years to support between approximately 360 pairs of owls under Alternative A and 1250 pairs of owls under Alternative L.

Table S-3

Estimated Number of Pairs of the Northern and California Subspecies That Could Be Supported Through Time on Federal Lands, Excluding the National Forests in the Pacific Northwest Region

Physiographic Province	Category of Land	Year 0	15	50	100	150
Olympic Peninsula	National Park [1]	37	37	37	37	37
Washington Cascades	National Parks [1]	17	17	17	17	17
Oregon Cascades	National Parks [1]	7	7	7	7	7
	BLM [2]	28+	28+	28	28	28
Klamath	National Forest in CA [3]	830	500	249	249	249
	National Parks [4]	31	31	31	31	31
	BLM in CA [5]	25		Unavailable		
	BLM in OR [2]	9+	9+	9	9	9
Oregon Coast Range	BLM [2]	42+	42+	42	42	42
Total estimated pairs of the northern subspecies		1026	671	420	420	420
Sierra Navadas	National Forest in CA [3]	730	440	265	265	265
	National Parks [4]	59	59	59	59	59
	BLM [5]	22		Unavailable		
Total estimated pairs of the California subspecies		811	499	324	324	324
Total of both subspecies		1837	1170	744	744	744

[1] These are habitat-based estimates of capability to support pairs of spotted owls. See Appendix B for derivation.

[2] Numbers shown for BLM areas in Oregon are the number of designated spotted owl habitat areas that will be maintained under current plans. At the current time, there is additional capability to support spotted owls. Charles Bruce, Oregon Department of Fish and Wildlife, Corvallis, OR, estimates that there are currently 250-300 spotted owl sites on BLM areas in Oregon (personal communication, July 15, 1986). This includes the Oregon Cascades, Klamath, and Oregon Coast Range provinces. This estimate is based on an approximate 30 percent reduction from the total of 400 sites located between 1969 and 1984. The total number of these sites that are currently occupied or are capable of supporting breeding pairs is unknown. In 1985, the BLM surveyed 278 sites and found 118 of them occupied by pairs of spotted owls and 59 occupied by single spotted owls (Bill Nietro, BLM, Portland, OR, personal communication, July 7, 1986). The number that will actually remain at year 15 is unknown.

[3] Current year figures are estimates of total current capability to support pairs of spotted owls based on data available as of January 1986. Source: Gordon Gould, California Department of Fish and Game (CDFG), Sacramento, CA (personal communication, July 14-15, 1986). Figures for later years are based on personal communication with Dale Avant, Forest Service, San Francisco, July 14, 1986. The figures at year 15 represent a 40 percent reduction from current levels. The figures for later years represent the count of designated spotted owl habitat areas plus additional capability on reserved lands.

[4] Figures are estimates of current capability to support pairs of spotted owls (Gordon Gould, CDFG, personal communication, July 14-15, 1986).

[5] Current year figures are estimates of total current capability to support pairs of spotted owls based on data available as of January 1986 (Gordon Gould, CDFG, personal communication, July 14-15, 1986). No estimates are available of habitat that will remain over time.

The numbers include all northern spotted owl habitat that remains on National Forest lands in the Pacific Northwest Region at that time. The estimates of viability of the spotted owl also took into account the contributions of other Federal lands in the range of the northern spotted owl that are displayed in Table S-1.

Table S-3 has been included in an attempt to display the trend on Federal lands of both northern spotted owls and the California subspecies in the Sierra Nevada Mountains. It includes projections through time for all Federal lands in these areas outside of Pacific Northwest Region National Forests. These figures differ from the figures used in the viability analysis for these other Federal lands (Table S-1) because (1) the figures in the viability analysis include only those habitats that are designated to be maintained over time; (2) the figures used in the viability analysis apply an estimated occupancy rate to the habitat areas on BLM areas and National Forests in northern California; and (3) the figures used in the viability analysis do not include the California subspecies in the Sierra Nevadas. The potential contribution of the California subspecies to viability of the northern subspecies is currently uncertain (see additional discussion in Chapter 4). This question will receive fuller attention in the final EIS.

The analysis indicates that the owl population on the Olympic Peninsula may be isolated from the population in the Washington Cascades. The population in Washington may be isolated from the population in Oregon if the Columbia River Gorge is an effective barrier to owl dispersal. Further information from monitoring or research is needed, however, to resolve this question. Under Alternatives A and B, the population in the Coast Range of Oregon may also become isolated.

Under any alternative, the greatest risks to the owl population are reduction in habitat combined with the low reproductive rate for the species and variations in this reproductive rate over time. Five categories were used to describe the probability that the spotted owl would persist to specified times in the future. These categories are as follows:

VERY HIGH (VH): Continued existence of a well-distributed population on the planning area at the future date is virtually assured. There is latitude for catastrophic events within the population or for findings that the species is less adaptable or that demographic or genetic factors are more significant than assumed in planning.

HIGH (H): There is a high likelihood of continued existence of a well-distributed population on the planning area at the future date. There is limited latitude for catastrophic events within the population or for biological findings that planning assumptions were in error.

MODERATE (M): There is a moderate likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic events, random demographic events, or genetic deterioration could result in extirpation of the species from parts of its geographic range.

LOW (L): There is a low likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic events, random demographic events, or genetic deterioration are likely to cause extirpation of the species from major parts of its geographic range.

VERY LOW (VL): There is a very low likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic events, random demographic events, or genetic deterioration are highly likely to cause extirpation of the species from major parts or all of its geographic range.

Results of the viability analysis suggest that the population on the Olympic Peninsula generally is at greater risk than other populations because of its small size and because it may be isolated from other spotted owl populations. The probability of the Olympic population persisting to 100 years ranges from very low under Alternative A to moderate under Alternative L. The probability of other northern spotted owl populations in Washington, Oregon, and northern California persisting to 100 years ranges from very low under Alternative A to high under Alternative L. Table S-4 is an example of the viability analysis results for a portion of the northern spotted owl population. See Chapter 4 for full results of the viability analysis, including results for the population on the Olympic Peninsula that may be isolated from the rest of the population.

Flexibility in Future Decision Making

The options for spotted owl habitat that will be available ten years hence is determined by the number and size of habitat areas designated now and management actions outside those areas. The effect of current decisions on flexibility to maintain future options hinges strongly on the choice of individual habitat size, i.e., whether that size will be 300, 1000, or some multiple of 2200 acres. For example, choosing Alternative C will reduce options to choose Alternatives D through L ten years hence. Accepting an alternative with 300 or 1000-acre habitat areas will probably foreclose the option to choose a 2200-acre alternative a decade from now because timber harvest during the decade will increase fragmentation and considerably reduce the opportunities to set aside 2200-acre areas ten years hence.

Within the range of the 2200-acre alternatives, the options to move to an alternative with a larger number of areas will become limited, but all options to manage for less acres per habitat area will be maintained. Alternatives F through K range from 550 to 1000 designated habitat areas, dispersed over the 13 National Forests. Choice of an alternative having 550 areas may foreclose an option to have 800 or 1000 areas in a decade since harvest will increase fragmentation and reduce opportunities for including additional areas in the future.

The choice of an alternative with habitat area greater than or equal to 2200 acres would maintain the option of choosing a smaller sized habitat area ten years from now if monitoring and research indicate owl viability would not be affected by these smaller units.

Table S-4

The Projected Probability, by Alternative, of Having a Well-Distributed Population of Northern Spotted Owls in the Washington Cascades, Oregon Cascades, Klamath, and Oregon Coast Range Physiographic Provinces

These results are based on the assumption that the Columbia River Gorge is not a barrier to owl dispersal

Alternative	Probability of persistence of well-distributed population by year				
	15[1]	50[3]	100[3]	150[3]	500[2][3]
A	M	L	VL	VL	VL
B	M	L	VL	VL	VL
C*	H	L	L	VL	VL
D	H	M	L	L	VL
E	H	M	M	L	L
F**[4]	H	H-M	M-L	L	L-VL
G	H	H	M	M	L
H	H	H	M	M	L
I	H	H	M	M	L
J	H	H	H	M	L
K	H	H	H	M	L
L	VH	VH	H	H	M
Alternative		Coast Range			
A		L	VL	VL	VL
B		L	VL	VL	VL

*No Action alternative **Preferred alternative

[1] Period of the Forest Plan.

[2] The decline in probability of persistence over time for virtually every population under every alternative is due to two factors. First, habitat is reduced over time because of timber harvest, and this decline in habitat will produce lower population sizes and greater risks from demographic, genetic, and catastrophic causes. Second, the probability of extinction occurring from any cause increases over time simply because the population has been exposed to risk for a longer period of time. Because the probability of extinction increases over time, probabilities of persistence at year 500 never exceed a rating of moderate and are generally either low or very low.

[3] Washington Cascades, Oregon Cascades, and Klamath areas only. Coast Range becomes isolated, as shown at bottom of chart.

[4] Some values are presented as a range because this alternative maintains the option to provide 1000-acre or 2200-acre habitat areas after the first decade.

Timber Management

The effect of the various alternatives on the timber resource is directly related to the number of acres that are withdrawn from timber management. Only those acres located on land suitable for timber production are considered in determining these effects. The 1.1 million acres of owl habitat located on wilderness and other reserved lands will not affect timber management. This figure of 1.1 million acres is the same in all alternatives. Table S-5 shows, for each alternative, the number of acres of owl habitat which would come from lands considered suitable for timber production.

Table S-5

Spotted Owl Habitat Acres in Suitable Timber Lands

Alternative	Designated Habitat From Suitable Timber Lands (acres)
A	0
B	24,897
C	77,343
D	313,839
E	509,779
F	313,839-690,446
G	690,446
H	948,246
I	1,120,306
J	1,390,366
K	1,837,211
L	2,618,125

As each alternative removes more acres from timber production, the amount of timber volume offered for sale declines. That volume in Alternatives G through L drops below the average annual quantity of 667.8 million cubic feet per year that had been offered for sale in the years 1978 through 1984. Except for Alternative A, the volume offered in all alternatives falls below the current potential yield of 732 million cubic feet per year. Figure S-1 illustrates the effect of each alternative on timber volume outputs over the first decade of harvest, stated in millions of cubic feet per year and using preliminary forest bench mark data sets.

Another effect of removing a large portion of the mature and old growth stands from the timber base is to redistribute the harvest to remaining stands not designated as habitat. This will include stands which have already been partially harvested. The rate of harvest in mature and old-growth not designated as spotted owl habitat will be increased. To partially offset the impact of designating spotted owl habitat there can be more intensive management of immature and pole-sized stands. This will increase the cost of timber management.

As more habitat is set aside for spotted owl management, less of the designated habitat areas will be in continuous blocks of unharvested timber. There will also be smaller blocks of unharvested timber outside the habitat areas. This fragmentation of timber stands increases the cost of harvesting the timber. The unit cost of building the roads and preparing the sale will increase.

All these factors will tend to decrease the supply of timber over the next 50 years from those National Forests having spotted owl habitat. In addition the acreage set aside for owl habitat will significantly reduce the amount of land available for timber management activities.

	Alternative											
First Decade	A	B	C	D	E	F*	G	H	I	J	K	L
MMCF/Yr	730.4	727.4	720.8	694.0	668.2	694.0	645.1	619.0	597.8	548.6	491.0	382.9
MMBF/Yr	3794	3778	3742	3604	3462	3606	3391	3219	3096	2843	2553	1971
% Volume Change from Alt. A	--	-0.4	-1.3	-5.0	-8.5	-5.0	-11.7	-15.0	-18.2	-24.9	-33.0	-47.6

Current Sell: (1975-1984) 660.9 MMCF/Yr; 3430 MMBF/Yr.
Current Cut: (1975-1984) 507.0 MMCF/Yr; 2631 MMBF/Yr.
Potential Yield: 732.0 MMCF/Yr; 3800 MMBF/Yr (from Timber Mgt. Plans, Post Wilderness Act)

*Preferred alternative

Figure S-1, The Summary of the Timber Volume Output, by Alternative Using Benchmark[1/] Runs. MMBF is a million board feet and MMCF is a million cubic feet.

**Preferred Alternative - Volume may range ± 2% (Ref. pp. 2-20.1).

1/ Benchmark data sets used for output estimates--not a summation of Forest Plan preferred alternatives.

Roadless Areas

The alternative selected will have an indirect but significant effect on the rate at which areas currently in a roadless condition are roaded and harvested during the next ten to 15 year plan period. The rate of roading and timber harvest during the next ten to 15 years from areas currently in a roadless condition would be least in Alternative A and much less in Alternatives B and C than Alternatives D through L, since these later

alternatives designate considerable owl habitat outside reserved areas. The maximum rate of entry of roadless areas would occur under Alternative J, K, and L. This is because as the size and number of habitat areas increases, more lands tentatively suitable for timber harvest within currently roaded areas will become unavailable within the next planning period and more need placed on maintaining programmed timber harvest from roadless areas. Alternative F will result in an entry rate into the roadless which is comparable to or slightly accelerated over Alternative I.

Economic

Table S-6 summarizes the direct employment and economic effects of the alternatives. It is likely that the displayed effects for the alternatives leading to the largest reductions in harvest are underestimated relative to those of the other alternatives. The reason is that the response of the wood processing industry to reductions in the supply of logs is "lumpy." As logs become scarcer, on average mills will first accept lower productivity without laying off workers; if supplies shrink further, they will begin layoffs; next some will temporarily close while installing new equipment, requiring fewer workers to process a given volume of logs; at the extreme, mills will go out of business. Since the estimates of state and Federal cash flows include tax receipts that depend upon employment and business income, those estimates also incorporate any biases that may exist.

In addition to reductions in direct employment, other jobs would be affected through the multiplier effect. These jobs are in industries that support the timber industry and its employees, such as equipment suppliers and grocery stores. The number of such jobs that would be affected can be estimated by multiplying the displayed numbers by 2.6. (See Chapter 4 for an estimate of related taxes.)

The alternatives with the greater harvest reductions and lower harvest levels could result in slightly higher levels of recreation use, and of related economic and employment benefits, than would otherwise be true. However, such positive effects would be unlikely to more than mitigate probable underestimates in the displayed effects for the large-reduction alternatives.

A key consideration is the degree to which other ownerships might divert logs now exported from the United States to domestic processing or increase harvests from their lands to "offset" any decreases in logs flowing from the National Forests. The capability to increase harvesting from other lands appears to be much less than estimated in the past. In addition, the responsiveness of log exporters to the modest increases in stumpage prices that are likely to result from the estimated decreases in harvests is unknown, but may well be small. Because any single estimate of offsets that might be provided by other owners would be highly speculative, a range -- which probably includes both too-high and too-low estimates -- is displayed.

Table S-6

Average Annual Reductions from Base Alternative A in National Forest Harvest Volumes and Consequent Reductions in Direct Employment and in Government Net Cash Flows During the Planning Period[1/]

Alt.	Harvest Volume MMBF	Direct Employment No. Jobs	Cash Flows U.S. Treasury Million Dollars	Cash Flows States Million Dollars
B	15.5	15[2/]	1	1
C	50.9	50[2/]	4	3
D & F[3/]	189.9	760 - 1330	18 - 21	10 - 11
E	323.9	1290 - 2260	31 - 38	17 - 19
G	442.7	1770 - 3100	42 - 50	23 - 25
H	580.2	2320 - 4060	51 - 62	29 - 32
I	699.5	2800 - 4900	65 - 78	36 - 40
J	944.2	3770 - 6600	88 - 106	49 - 54
K	1244.6	4975 - 8710	117 - 140	65 - 71
L	1804.2	7215 -12630	172 - 206	97 - 105

[1/] The current level of employment is the level expected to be associated with Alternative A; this level is about 82,500 in the forest products industry. Low estimates assume other ownerships will offset 50 percent of harvest reductions. High estimates assume no offsets.

[2/] Relatively small reductions in harvest would not affect significantly private sector employment in logging or wood processing; Forest Service employment would decrease.

[3/] Alternatives have same effects during the planning period.

It would probably not be possible for non-National Forest ownerships in the Northwest to maintain their current levels of harvest beyond 20 years. This means that any near-term increase in harvest, to offset National Forest reductions, would lead to an earlier decrease in total Regional harvest levels and further decreases in timber industry employment. While increased levels of protection would preserve a wider array of options to provide habitat in the future, those levels also would lead to reductions in future timber harvest options and a moving forward of the time when significant economic adjustments within the Region will take place.

The reasonableness of estimates of effects partly depends upon the state of the general economy in the Northwest. If the current overall unemployment rate of slightly more than 8 percent, with higher rates in timber-dependent areas, continues it is unlikely that employees discharged from the wood processing industry would readily find other comparable employment. To the extent that re-employment opportunities do exist in the future, the lower estimates of employment losses and adverse economic effects in Table S-6 would be more likely. Similarly, estimates of Federal and state cash flow reductions overstate net effects because they ignore possible offsetting increases in industrial activities elsewhere.

The negative consequences of harvest reductions would not be spread evenly throughout the Region. Although all displaced workers would face hardships and any layoffs pose problems to communities, the impacts would generally be least on communities in Washington. In contrast, relatively modest reductions in National Forest harvests could pose serious problems for the economies of many communities in western Oregon. This is because a large portion of the economic activity most critical to the stability or growth of such areas is directly dependent upon logs flowing from the National Forests. The areas most effected by decreases in employment would suffer the largest reductions in payments to counties and local tax payments.

Table S-7

Tradeoffs During the Planning Period Between Increases in Protection for Spotted Owls Beyond Alternative A and Reductions in Direct Employment and Cash Flows

Alt.	End of Plan Period Habitat Capability		Reduction per Additional Pair of Owls[1/]		
			Direct	Cash Flows	
	Total	Increase	Employment	U.S. Treasury	States
	(Pairs of Owls)		(No. of Jobs)	(Millions of Dollars)	
B	836	4	4	3.3	1.8
C	859	27	2	1.5	1.0
D	917	85	9 - 16	2.1 - 2.5	1.2 - 1.3
E	953	121	11 - 19	2.6 - 3.1	1.4 - 1.6
F*	929	97	8 - 14	1.8 - 2.2	1.0 - 1.1
G	952	120	15 - 26	3.5 - 4.2	1.9 - 2.1
H	955	123	19 - 33	4.2 - 5.1	2.4 - 2.6
I	1,039	207	14 - 24	3.1 - 3.8	1.7 - 1.9
J	1,095	263	14 - 25	3.4 - 4.0	1.9 - 2.0
K	1,100	268	19 - 33	4.3 - 5.2	2.4 - 2.6
L	1,248	416	17 - 30	4.1 - 5.0	2.3 - 2.5

* Preferred alternative

1/ Low estimates assume other ownerships will offset 50 percent of harvest reductions; high estimates assume no offsets. Estimates of cashflows are totals for 10 years. To estimate other jobs affected through multiplier effect, multiply displayed numbers of jobs by 2.6.

Table S-7 summarizes major tradeoffs involved in implementing each of the alternatives. Habitat capability at the end of the planning period will define the maximum number of owls that can be supported in future decades and may limit the options for future decisions. To the extent that the precise distributions of habitat (that must be defined on a forest-by-forest basis) or other considerations not reflected in the left-most columns are important, this table may be misleading. Note that the estimated reductions in cash flows are totals for ten years. The estimates of employment and economic effects are subject to the qualifications discussed earlier.

Irreversible and Irretrievable Commitment of Resources

Monitoring and research during the next planning period may confirm that owls generally use more or less than the habitat area designated under the selected alternative. Should this require more habitat than is being provided, there would be an irreversible effect associated with the selected alternative, because suitable owl habitat will have been harvested and therefore would not be available for use in designated habitat areas. Habitat presently unsuitable for spotted owls could be grown into the suitable category for future use by owls beginning immediately by formally designating these areas.

Unavoidable Adverse Environmental Effects

Implementation of any alternative except Alternative L will result in the continued harvesting of suitable owl habitat on lands suitable for timber production. As the owl habitat is harvested, it will become more fragmented. Stands of mature and old-growth timber not designated as habitat areas will become smaller and more widely scattered. This will negatively affect juvenile owls when dispersing. It will be more difficult for them to find unoccupied habitats. Therefore, juvenile dispersal mortality may rise.

Mitigation Measures

A measure common to each alternative to prevent reduction in designated suitable owl habitat would be the designation of mature stands of timber to serve as replacements should the designated habitat areas become lost because of catastrophes.

Another measure common to all alternatives would be to transport owls or eggs to reestablish populations or ensure genetic diversity in isolated populations. (See Chapter 4 for a discussion of demographic intervention.)

Measures related specifically to certain alternatives are as follows:

Alternative A: The addition of more habitat areas in lands suitable for timber production at some later date.

Alternatives B-E, G-K: The designation of mature stands of timber to serve as replacements should the linking areas be lost due to catastrophes.

Alternative D-E, G-K: Make no adjustment in the calculation of timber volume to be sold for owl habitat areas located on lands suitable for timber production.

Incomplete Information

The following areas of incomplete information were identified during the viability analysis. They also became apparent from a review of the current spotted owl literature.

1. The amount of suitable habitat needed by a pair of spotted owls.

2. The specific habitat elements that are critical to spotted owl survival.

3. The population characterisitcs of spotted owls. These include life expectancy, age structure, juvenile survival rate, frequency of vacant habitat colonization, effects of forest fragmentation, first and last ages of successful breeding, and rates of birth.

4. Possible isolation of spotted owl populations because of barriers such as large bodies of water.

Monitoring and Research

Monitoring and research is viewed as a mitigation measure designed to remove important areas of incomplete information over the next ten years. (See Appendix D for detailed discussion.)

Chapter 1

PURPOSE AND NEED

OVERVIEW

This document is a Draft Supplement to the Final Environmental Impact Statement (FEIS) for the Pacific Northwest Regional Guide dated May 1984. As such, it is intended to be a part of that FEIS, rather than a separate document. The standards and guidelines determined through this process will be used to develop the ten to 15 year Forest Land and Resource Management Plans for National Forests in the Pacific Northwest Region. Sections of this Supplement are to supercede specific pages of the FEIS. Where this occurs, it will be noted throughout the document. This section supercedes "Planning Questions Associated with Regional Issues and Concerns" on page 1-4 of the FEIS for the Pacific Northwest Regional Guide. The alternative adopted as a result of this Supplement will serve as an amendment to the Regional Guide, to supercede the paragraphs on pages 3-12, 3-13, 3-14, and 3-15 under the heading titled Northern Spotted Owl Habitat Management.

One of the purposes of the Regional Guide is to address major Regional issues and to provide standards and guidelines to the National Forests for use in preparing land and resource management plans (36 CFR 219.9). The northern spotted owl has been identified as a major Regional issue.

This Supplement is the result of an appeal decision by the Secretary of Agriculture requiring the Forest Service to consider recent biological information concerning habitat requirements of the northern spotted owl. The standards and guidelines adopted as a result of this Supplement will ensure the maintenance of a viable population of northern spotted owls (36 CFR 219.19).

This Supplement examines 12 alternatives for management of northern spotted owl habitat within the Pacific Northwest Region of the United States Department of Agriculture, Forest Service. These alternatives encompass a wide range of possible standards and guidelines as well as the general Regional effects of implementing these standards and guidelines. Although these alternatives can be viewed as presenting "tradeoffs" between the various standards and guidelines and resource outputs, the decision as to which alternative to adopt will not be made strictly on the basis of a "tradeoff" analysis. In accordance with the National Forest Management Act of 1976 and national Forest Service policy, the adopted alternative must ensure that a viable population of northern spotted owls will be maintained. Therefore, the decision will be made primarily on the basis of the biological requirements for maintenance of viability.

The alternatives vary in their emphasis on the benefits produced and cover a wide range of possibilities for managing spotted owl habitat within the Pacific Northwest Region. The standards and guidelines associated with these alternatives do not specify land uses, nor do they specify actions to be taken on any specific land area in the Region. Rather they guide the decisions that are made in individual National Forest Plans regarding what actions are to be taken concerning a specific area. The guidelines will be used by individual National Forests during their first ten year forest planning period to assure viability of northern spotted owl on a Regional basis. The environmental effects described in this document are the Regional consequences of using these standards and guidelines on individual National Forests. The more site-specific consequences of these guidelines will be analyzed in development of the National Forest Plans.

Forest Plans on the 13 National Forests in the Pacific Northwest Region which contain spotted owl habitat are currently in preparation and have incorporated the standards and guidelines contained in the preferred alternative of this Supplement. Although the standards and guidelines contained in this Supplement pertain to the management of spotted owl habitat in Oregon and Washington only, they were developed using biological data from the entire range of the northern spotted owl, including the four National Forest in northern California (Pacific Southwest Region) that have spotted owl populations. Should the management standards and guidelines change from those in the preferred alternative, the Forest Plans may need to be supplemented or amended to reflect this change depending upon whether the Draft or Final Environmental Impact Statement to these Plans have been published.

The preferred alternative is selected by the Chief of the Forest Service, as the one which is thought to provide the best mix of benefits for the public and which will assure the viability of northern spotted owls. The preferred alternative states the current preference to manage northern spotted owl habitat in the Pacific Northwest Region.

It is important to remember that this Supplement in its present form is a draft document. Both the Supplement and that portion of the Regional Guide related to northern spotted owls are subject to revision based on the comments received during the review period. The review period is 90 days from the publication of the Draft Supplement. The public will be able to contribute to the final selection of an alternative management strategy by submitting information for consideration. Each person will be able to use the Supplement to determine which alternative best meets their preferences. Interested individuals and organizations are encouraged to comment on the findings of this Supplement for consideration in preparation of the Final Decision.

Following the 90-day review period, the comments will be analyzed and a Final Environmental Impact Statement prepared. The alternative selected for implementation will be documented in the "Record of Decision" made available to the public. This decision will be to adopt Regional standards and guidelines to apply to National Forests containing spotted owl habitat. These standards and guidelines are designed to meet Title 36 Code of Federal Regulations 219.19 (36 CFR 219.19) requirements for ensuring a

viable population of spotted owls. The selected alternative with associated standards and guidelines will serve as an amendment to the Regional Guide of May 1984 and replaces those sections within the Guide which discuss the management requirements necessary to ensure continued viability of the northern spotted owl.

As the Regional Guide and Forest Plans are implemented, they will be monitored to determine if the actual effects as described in the Supplement are close to what was predicted and if the management direction, as given in the selected alternative and associated standards and guidelines, was followed. As new information is obtained during monitoring or as a result of research on spotted owls, the Regional Guide may require amendment or revision.

All the documents and files that chronicle the development of this Supplement are available for public review at the Regional Forester's Office, Third and Pine Street, Portland, Oregon. These planning records contain the detailed information used in developing the Supplement.

HISTORICAL PERSPECTIVE OF SPOTTED OWL MANAGEMENT IN PACIFIC NORTHWEST REGION

The northern spotted owl became a Regional concern in the early 1970's. In 1973, an interagency committee was organized, consisting of biologists from the U.S. Department of Agriculture, Forest Service; the U.S. Department of Interior, Bureau of Land Management; the U.S. Department of Interior, Fish and Wildlife Service; the Oregon Department of Fish and Wildlife; and Oregon State University. This committee, known as the Oregon Endangered Species Task Force, began to develop guidelines for spotted owl management. The Task Force recommended that 300 acres of old-growth forest be retained around every known spotted owl nest site. The Regional Forester of the Pacific Northwest Region and the Oregon State Director of the Bureau of Land Management issued a joint memo in August 1973 stating that they had declined to accept the recommendations.

During the next three years, publications providing information about the needs for spotted owl habitat appeared in the scientific literature (Gould, 1974; Forsman, 1976). In November 1976, the Regional Forester directed that nesting sites of spotted owls be protected on National Forests in Oregon until Biological Unit Management Plans were developed (memo of November 11, 1976, from Director of Fish and Wildlife, Pacific Northwest Region).

At a December 13, 1976, meeting, the Oregon Endangered Species Task Force recommended a long-range goal for management of the spotted owl and a set of interim guidelines. The long-range goal was to maintain 400 pairs of spotted owls on public lands in Oregon. The Task Force proposed to spend one year (that is, 1977) developing objectives and management prescriptions to meet that goal. For that one year period, the Task Force recommended that involved agencies protect locations around spotted owl nests and areas where owls have been sighted.

The Regional Forester responded to the Task Force recommendations in May 1977. He agreed to protect spotted owl habitat using the Task Force recommendations, except where timber sales already existed or were planned for sale in 1977 (2400 (2600) memo of May 17, 1977, signed by Deputy Regional Forester Torrence).

On November 3, 1977, the Oregon Endangered Species Task Force released its Interagency Spotted Owl Management Plan. In the Plan, the National Forests in Oregon were requested to support at least 290 pairs of owls, the Bureau of Land Management was asked to support 90 pairs, and 20 pairs were identified for lands in other ownerships. A minimum of 1200 contiguous acres was to be provided for each owl pair consisting of a core area of at least 300 acres of old-growth conifer forest (that is, to the extent it was available) and an additional 900 acres of which at least 50 percent was to be in stands greater than 30 years of age. Additional criteria were given relating to the distribution and proximity of pairs.

The Regional Forester accepted the Interagency Spotted Owl Management Plan on February 21, 1978, with the stipulation that a final decision on the distribution, location, and number of pairs would be made through public involvement as National Forest land management plans were developed (February 21, 1978) memo from Regional Forester Worthington to Forest Supervisors).

In April 1978, because of interest by biologists in Washington State and other emerging issues, the Oregon-Washington Interagency Wildlife Committee (OWIWC) was formed. The Committee had a Spotted Owl Subcommittee that replaced the Oregon Endangered Species Task Force. In May 1979, the Oregon Interagency Spotted Owl Management Plan of November 1977, which had been unchanged up to that time, was slightly modified through an update.

On January 11, 1980, the Oregon Wilderness Coalition and others filed an appeal of the Regional Forester's decision not to prepare an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) on the use of the Spotted Owl Management Plan of the Oregon Endangered Species Task Force. On August 11, 1980, the Chief of the Forest Service upheld the Regional Forester's decision. In doing so, the Chief directed that the Regional Plan and accompanying EIS include the following: (1) a biological analysis to determine the number and distribution of spotted owls that constitute a viable population; (2) Regional management and monitoring standards; and (3) an evaluation of needed research. The Chief also directed, that until the Regional Plan was approved, the Regional Forester should protect 290 owl pairs in Oregon using the guidelines in the Interagency Spotted Owl Management Plan. Options to manage for levels higher than this tentative allocation were to be maintained for Forest Plans.

In August 1980, the Regional Forester transmitted the Chief's decision to Forest Supervisors, advising them of its requirements that National Forests in Oregon protect all known and newly discovered pairs of owls until each National Forest's share of the allocated 290 pairs was confirmed (1570 memo of August 28, 1980). Where necessary, adjustments were to be made to timber sales after October 1, 1980.

Because the Regional Forester recognized the Region-wide nature of the spotted owl management question, he gave direction in October 1980 to the National Forests in Washington to provide protection to spotted owls (1570 [2670] memo of October 28, 1980, to Forest Supervisors). Washington National Forests with spotted owls were to protect all confirmed owl pairs in accordance with the Interagency Spotted Owl Management Plan, pending a tentative allocation for the National Forests in Washington and further direction in the Regional Plan. In April 1981, the tentative allocations of spotted owls were assigned for the Gifford Pinchot, Mt. Baker-Snoqualmie, Olympic, and Wenatchee National Forests (2670 memo of April 20, 1981, from Regional Forester). These allocations for Washington totaled 112 pairs of owls.

During 1979 and 1980 the Spotted Owl Subcommittee of the OWIWC considered the need to revise the Spotted Owl Management Plan Guidelines in light of additional research and information. Results of radio-telemetry studies of spotted owls by Eric Forsman became available to the Spotted Owl Subcommittee in December 1980. These studies indicated that, in 14 home ranges, the amount of suitable habitat used by owls was much more than 300 acres. The Spotted Owl Subcommittee also worked with other consultants during 1980. Dr. Michael Soule recommended a goal of more than 500 pairs to prevent local populations from becoming isolated.

Based on the report from Forsman (1981) and consultation with Soule, the Oregon-Washington Interagency Wildlife Committee revised the Interagency Spotted Owl Management Plan in February 1981. The revision called for 1000 acres of old-growth habitat to be maintained for each spotted owl pair: 300 acres around the nest site, if known, and an additional 700 acres within 1.5 miles of the nest site.

In May 1981, the Regional Forester issued a Draft Pacific Northwest Regional Plan. The Draft Regional Plan contained recommended numbers of owl pairs and requirements on distribution to be evaluated in Forest planning. It also included, in an Appendix, the February 1981 revision of the Oregon Interagency Spotted Owl Management Plan.

In 1982, Forest Service personnel in management and research began efforts to learn more about managing spotted owl habitat. To this end, the Forest Service, in cooperation with the Bureau of Land Management, initiated an Old-Growth Wildlife Research and Development program. Also in 1982, the Washington Office Wildlife and Fisheries Staff sponsored a workshop to allow population experts to meet and develop planning procedures that would assist in providing for viable populations of spotted owls.

In September 1982, planning regulations of the National Forest Management Act (NFMA) were revised (36 CFR 219, Federal Register, September 30, 1982). Included in the revisions was the requirement for the preparation of a Regional Guide and the elimination of the need for a Regional Plan.

During the latter half of 1982, as part of the process of developing Forest Plans, planning team leaders and biologists from the National Forests in the Region met to identify the management requirements that were mandated by law and regulation, and to discuss how these requirements would be met

in Forest Plans. Requirements for protection of spotted owls originate in Section 219.19 of the planning regulations which requires the management of habitat to maintain viable populations of native vertebrate species. The Forest planning direction that came out of these discussions incorporated the habitat guidelines of the proposed revision of the Oregon Interagency Spotted Owl Management Plan of February 1981. This planning direction was sent to Forest Supervisors on February 9, 1983 as "Regional Guidelines for Incorporating Minimum Management Requirements in Forest Planning" (1920 memo of February 9, 1983, from the Regional Forester).

During 1984, more information about spotted owls was published in a wildlife monograph by Forsman and others (1984). In May 1984, the Final Regional Guide and accompanying FEIS for the Pacific Northwest Region were published. These documents replaced the Draft Environmental Impact Statement for the Regional Plan.

The Regional Guide Standards and Guidelines for spotted owl habitat management focused on how such management would be considered in the Forest planning process. They also gave direction for habitat management until the Forest Plans were approved. The Regional Guide directed the National Forests, during the development of the Forest Plans, to analyze the effects of meeting an assigned number of pairs of spotted owls. The total number of spotted owl pairs to be tested in this manner was 375, which was considered to be the level of the minimum viable population in the Region. The Regional Guide also directed that National Forests consider among their Forest Plan alternatives one alternative providing for the National Forest's share of the 375 pairs and one alternative providing for 30 percent above that level. The 1981 Proposed Revision of the Oregon Interagency Spotted Owl Management Plan was to be the basis for this consideration in developing the Forest Plans. (Regional Guide for the Pacific Northwest Region, 1984, pages 3-12 to 3-15.)

Interim direction in the Regional Guide specified that, until Forest Plans were approved, National Forests were to manage for spotted owls in compliance with the tentative Region-wide level of 402 pairs (See Appendix C), with each pair being allocated 300 acres of old-growth habitat as based on the guidelines in the 1979 Interagency Spotted Owl Management Plan. It was recognized that new or additional inventories might increase the number of pairs. This did happen; and consequently, interim protection is being provided to 417 pairs of owls on National Forests in the Region.

In April 1984, the Regional Office established additional criteria for meeting minimum management requirements in Forest planning (1920 memo of April 16, 1983, to Forest Supervisors). These criteria established standards for the distances between habitat areas. National Forests used these spacing requirements to map habitat areas for spotted owls, thereby deriving a total of 551 habitat areas. These were then considered necessary to meet minimum requirements. The 551 habitat areas, therefore, became a part of the Minimum Management Requirements and superseded the numbers to be analyzed in Forest planning given in the Regional Guide. For the Pacific Northwest Region, it was then considered that a viable population was to be provided by managing 551 spotted owl habitat areas with 1000 acres in each area.

On October 22, 1984, the National Wildlife Federation, the Oregon Wildlife Federation, the Lane County Audubon Society, and the Oregon Natural Resources Council appealed the decision of the Chief of the Forest Service approving the Regional Guide for the Pacific Northwest Region and adopting standards and guidelines for the management of spotted owls. The Chief's decision as it related to spotted owls was reversed by the Deputy Assistant Secretary of Agriculture, and the Regional Guide and accompanying EIS remanded to the Regional Forester for preparation of a Supplement to more adequately consider recent biological information and issues associated with spotted owl management (March 8, 1985, letter from Deputy Assistant Secretary for Natural Resources and Environment).

Figure 1-1 illustrates the historical development of criteria for number of spotted owl pairs and number of acres per pair in the Pacific Northwest Region.

Year	Activity	No. Pairs	Acres/Pair
1977-1978	Oregon Endangered Species Task Force Recommendations (Oregon Only)	290 pairs	300 acres
1980	Regional Forester Gave Direction to National Forests in Washington	112 pairs	300 acres
1981	The Draft Pacific Northwest Regional Plan with Interagency Spotted Owl Management Plan in an Appendix	402 pairs	1000 acres
1984	Regional Guide for the Pacific Northwest Region (Replaces Regional Plan) Direction for Evaluation in the National Forests' "Analysis of the Management Situation"	375 pairs	1000 acres
1984	Regional Guide for the Pacific Northwest Region Interim Direction	402 pairs	300 acres
1984	Inventories by National Forests	417 pairs	300 acres
1984	Minimum Management Requirements	551 pairs	1000 acres

Figure 1-1. Development of Numbers of Pairs of Owls to be Protected and Numbers of Acres per Pair from 1977 to 1984, relating to the discussion on pages 1-3 through 1-6.

ISSUES AND CONCERNS

The appeal to the Secretary was based on the treatment of the spotted owl issue in the FEIS for the Regional Guide, which the appellants thought to be inadequate. Because the issues raised in the appeal were limited to the need for protection of spotted owls, all other parts of the Regional Guide were considered final. The Deputy Assistant Secretary directed the Chief of the Forest Service to prepare a Supplement to the EIS for the Regional Guide. The Supplement was to address the issue raised in the appeal, that is, the issue of spotted owls and develop alternatives for addressing this issue.

According to the direction to the Chief, the Supplement was to evaluate and disclose the biological and social and economic effects of the alternatives. In particular, it was to discuss the following: (1) Current knowledge on the status and biology of the northern spotted owl; (2) The ongoing research of the requirements in habitat of the owl; (3) An inventory of old growth and suitable habitat on lands under all ownerships; (4) An inventory of old growth and suitable habitat on land managed for uses other than timber production; (5) The current rate of reduction of old growth and suitable habitat as well as projections on the implications for the viability of the owl; (6) The amount of habitat and the distribution and minimum number of pairs of owls needed to maintain their viability; (7) An examination of areas outside the Pacific Northwest Region; (8) Monitoring and evaluation; and (9) The role of the Regional Office in assuring the continued viability of the spotted owl (Letter from Deputy Assistant Secretary for Natural Resources and Environment, Douglas W. MacCleery to Chief, R. Max Peterson, March 8, 1985).

According to the direction given in the Deputy Assistant Secretary's letter, the planning question for the Supplement is, therefore, "How should the National Forest's maintain viable populations of northern spotted owls?" The Forest Service then proceeded to the first step in preparation of the SEIS. This was to discover the range and number of issues involved with the spotted owls, as perceived by the public. A number of people in the Pacific Northwest are intensly interested in the issues underlying the preparation of the Supplement. Those most concerned generally fall into two groups: those individuals and organizations that are conservationists or environmentalists and those individuals and organizations that are related to the wood products industry.

After reviewing the Deputy Assistant Secretary's letter and other correspondence with interested individuals and groups, the Interdisciplinary Team identified those issues and concerns which address the planning question that has been stated previously. Refer to Appendix A for a detailed description of the development of issues and concerns.

The issues and concerns are listed as follows:

1. The Regional Guide for the Pacific Northwest Region has been challenged as failing to consider the cumulative impacts of timber harvesting on the spotted owl. Two topics closely related to timber harvesting have been raised by some members of the public:

a. Some individuals, as Lande, 1985, feel harvesting of old-growth forests in the Pacific Northwest has jeopardized spotted owl viability, will lead to extinction of the species, and will reduce management options for insuring its viability.

b. Some have suggested that timber stand management, including timber harvest, could provide spotted owl habitat.

2. Current management guidelines in the Regional Guide are based on incomplete information and uncertain assumptions concerning the probable impacts of harvesting timber on spotted owls.

3. If the Forest Service proceeds with its current timber harvest in the face of inadequate knowledge, it should consider the risk to maintaining a viable population.

4. There are economic and social effects associated with alternative levels of protection of spotted owl habitat. These effects are primarily related to the resultant level of timber harvest. In addition to indirect effects on communities, they specifically include:

   a. Effects on the supply of timber in Oregon and Washington.

   b. Changes in revenues to counties and the Federal Treasury.

   c. Effects on dependent communities and jobs.

5. The Forest Service should minimize impacts to management of other resources while protecting spotted owl habitat.

6. There is disagreement about the habitat requirements of northern spotted owls.

The analysis of spotted owl management in the Pacific Northwest Region and the development of alternatives are designed to address these issues and concerns. Management standards and guidelines have been prepared to give direction to the National Forests detailing how viable populations of the northern spotted owl are to be maintained. These management standards and guidelines are presented in Chapter 2.

Chapter 2

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

NORTHERN SPOTTED OWL HABITAT MANAGEMENT

This section supercedes pages 2-24, under the heading "Northern Spotted Owl Habitat Managegement", through 2-29 of the Final Environmental Impact Statement for the Pacific Northwest Regional Guide.

The habitat of the spotted owl may be significantly influenced by planned management programs. This Supplement addresses a broad range of alternatives to be considered for the management of northern spotted owl habitat. The Interdisciplinary Team developed an initial set of 20 alternatives. This initial set of alternatives came from a variety of sources, including the alternatives given in the Notice of Intent, suggestions from the Appellants and Intervenors, and workshops with the Interagency Spotted Owl Subcommittee. A summary of the Alternative Development Process is in the Regional Office Land Management Planning records.

Alternatives Considered and Eliminated from Detailed Study

In reviewing the initial set of 20 alternatives to select those to be studied in detail, the Interdisciplinary Team considered:

1. If any of the 20 alternatives were similar or used alternative methods to meet the same objective.

2. If any of the 20 alternatives could better be used as a method of implementation for certain other alternatives, rather than considered separately.

3. If the alternatives represented as wide a range as possible.

4. If all the alternatives within this range were reasonable.

Based on these criteria, it was decided that the following alternatives could be eliminated from further study.

No formal measures to protect the habitat of the spotted owl, with artificial transport to provide genetic interchange. Under this alternative, the Pacific Northwest Region of the Forest Service would make no land use designations to retain spotted owl habitat on that land suitable for timber production. Instead, the Forest Service would rely on the future capture and transportation of owls to provide genetic

interchange between populations which would become isolated as owl habitat on lands suitable for timber production is harvested.

The amount of spotted owl habitat provided in this alternative is identical to the amount of habitat provided in Alternative A. The probability that spotted owls would persist is expected to be the same or slightly better than Alternative A, assuming that genetic interchange would be a limiting factor. The viability analysis showed that birth and mortality rates, not genetics, were the important factors influencing spotted owl viability. (Refer to Appendix B.) This led to the conclusion that effects on spotted owl viability from this alternative would be identical to Alternative A. The effects on other resources, timber outputs, and economics would also be the same as in Alternative A. This alternative was eliminated from further analysis because of the similarities with Alternative A.

Provide habitat areas for a high density population of spotted owls with assured genetic interchange. To the extent possible, these habitat areas would be on lands unsuitable for timber production. Should populations become isolated, genetic interchange would be provided by the artificial transportion of owls or eggs. The habitat areas would be selected from high quality habitat sites which would encourage the owls to live closer together because less habitat would be needed for foraging.

In terms of the probability of persistence of spotted owl populations, this alternative would be slightly better than Alternative A because more habitat would be provided. Because, for the most part, the additional habitat would come from areas not suitable for timber production, the effects on other resources, timber harvest, and economics would be the same as in Alternative A. This alternative was eliminated, therefore, from detailed analysis because of its similarities with Alternative A.

Provide 275 habitat areas for spotted owls with each habitat area containing 300 acres. Under this alternative, the Pacific Northwest Region of the Forest Service would drop the number of required habitat areas to fewer than those currently being maintained on the 13 National Forests in the Region that have spotted owl habitat. To the extent possible, the 300 acres of habitat would be one contiguous stand of old-growth timber.

This alternative is similar to Alternative B which has 261 habitat areas. As such, it could be expected that there would be no difference between the two alternatives in the probability of persistence of spotted owl populations, effects on other resources, timber harvested, or economic effects. This alternative was eliminated from detailed analysis because of its similarities with Alternative B.

Provide 810 habitat areas for spotted owls with each habitat area averaging 2200 acres. To the extent possible, the acres of habitat would be contiguous stands of mature and old-growth forests. This alternative would establish 1,361,800 acres of spotted owl habitat in lands tentatively suitable for timber production.

This alternative is similar to Alternative I. There is little difference between the two in the number of habitat areas and the size of the habitat

areas. Alternative I provides for 1,120,306 acres of spotted owl habitat in lands tentatively suitable for timber production, an amount that is only slightly lower than that provided by this alternative. For these reasons, it is expected that the effects of this alternative would be the same as that of Alternative I and it was, therefore, eliminated from detailed study.

No further reduction in spotted owl habitat. Under this alternative, 2.5 million acres of land, suitable for both spotted owl habitat and timber production, would be unaltered. There would be no timber harvest on these acres. The 2.5 million acres is in addition to the 1.1 million acres of suitable spotted owl habitat estimated to be in areas not suitable for timber production.

The effect of this alternative on the probability of persistence of spotted owl populations in the first three decades would be identical to the effects of Alternative L. After three decades there would be slightly less habitat than that provided for in Alternative L because of the growth of 180,000 acres of capable spotted owl habitat into a suitable habitat condition. This alternative, therefore, was eliminated from detailed analysis because of its similarities with Alternative L.

Provide 594 habitat areas in Oregon, 63 habitat areas in the Olympic National Forest, and 343 habitat areas in other National Forests in the State of Washington, each habitat area averaging 2200 acres. The numbers and distribution of habitat areas have been tailored to fit each major physiographic province of the region.

This alternative is similar to Alternative J. It actually provides criteria for distribution that could be incorporated into the habitat area assignments given to each National Forest in the Region. This alternative became the modeling assumption for distribution used in Alternative J and was therefore eliminated from detailed analysis.

Provide 550 habitat areas for spotted owls with each habitat area averaging 2200 acres and, in the future, manage every other first-order watershed in the Region containing suitable and capable owl habitat to provide spotted owl habitat. Under this alternative, the 550 habitat areas could be harvested when the goal of providing suitable owl habitat in every other first-order watershed is reached.

Two approaches were used to model timber yields on lands designated as spotted owl habitat; these were managed and dedicated. With a managed approach, timber harvest may be scheduled in spotted owl habitat areas. The rate of harvest, however, would be greatly reduced in order to produce the characteristics of desirable habitat. For example, the normal harvest rotation of 100 years might be extended to 300 years to produce large, living trees and snags, both of which are an important component of spotted owl habitat. With a dedicated approach, the acres of spotted owl habitat are simply left alone, without being managed. Timber harvest would not occur, except possibly following a catastrophe. No timber yields would be calculated for these lands.

Both the management and dedication of habitat are permitted in the standards and guidelines for those alternatives with owl habitat on lands suitable for timber production. Aspects of this alternative are, therefore, used as a method of implementation. In addition, this alternative would result in about the same amount of owl habitat as in Alternative L, and could be expected to have similar results. It was, therefore, eliminated from detailed study.

Provide habitat areas suitable for spotted owls by reserving from harvest 5 percent of each drainage. Under this alternative, 125,000 acres of spotted owl habitat would be retained on lands tentatively suitable for timber production. The requirement to reserve 5 percent of each drainage would ensure a fairly uniform distribution of habitat.

This alternative is similar to Alternative C which has 77,000 acres of spotted owl habitat on lands tentatively suitable for timber production. The requirements in this alternative will achieve a distribution pattern of habitat areas similar to that of Alternative C and could be expected to produce similar effects. It was, therefore, eliminated from detailed study.

Provide 550 habitat areas for spotted owls with additional areas designated to replace these initially established areas as they are lost to catastrophic events or harvesting. Under this alternative, the timber yields on all present and future spotted owl habitat areas would be calculated on the basis of extended rotations.

The provisions of this alternative could be incorporated into the guidelines to implement the selected alternative. It could be used with any alternative in which habitat areas are formally designated. It was, therefore, not selected for detailed analysis.

Provide habitat protection for spotted owls with no adjustment in Allowable Sale Quantity until the next planning period. Under this alternative, the Forest Service would protect spotted owl habitat, but not reduce the supply of timber over the next ten years.

This alternative, which could be modeled as a departure from a base sale schedule, would delay the adjustments in the timber harvest from current levels of harvest until the next plan period. It is an option that will be tested as a mitigating measure in at least one of the alternatives selected for detailed analysis. It was, therefore, not considered as a separate alternative by itself.

Provide a combination of alternatives tailored to fit the ecological conditions of individual National Forests. Under this alternative, some of the features of the other alternatives could be combined and modified to recognize and respond to the variety of conditions among the National Forests.

This approach was actually used to develop four of the alternatives selected for detailed analysis, including Alternatives F, G, H, and K. It was not considered reasonable to present an alternative which would allow

the individual National Forests to select a combination of alternatives. The reason is the necessity to treat the spotted owl habitat across the Region instead of by individual National Forests. This alternative was, therefore, eliminated from detailed analysis.

Provide 620 habitat areas for spotted owls with each habitat area averaging 1600 acres. Under this alternative there would be 627,200 acres of suitable owl habitat designated on lands tentatively suitable for timber production.

The amount of habitat in this alternative compares very closely with Alternative E, which has 509,779 acres of spotted owl habitat on lands tentatively suitable for timber production. The distribution of 620 habitat areas would not be quite as thorough as with the 810 habitat areas provided in Alternative E. The larger size of habitat area could be expected to offset the advantage in distribution of Alternative E. This alternative is expected to have about the same probability of persistence of spotted owl populations as Alternative E and nearly identical effects on other resources, timber harvest, and economics. It was, therefore, eliminated from detailed analysis.

Alternatives Considered in Detail

These alternatives deal with spotted owl habitat management decisions being made on the 13 National Forests of the Pacific Northwest Region that have spotted owl habitat. More specifically, the changes in spotted owl habitat on lands also suitable for timber production have been highlighted. The following list contains four additional alternatives that were developed during the analysis and internal review process.

At this level of analysis, the forested lands on the 13 National Forests with spotted owl habitat have been divided into two catagories: lands tentatively suitable for timber production and lands not suitable for timber production. Those lands that have been withdrawn from timber production by the Chief of the Forest Service or higher authority including, for example, wildernesses and research natural areas, are not suitable for timber production. Lands where there is not assurance that regeneration can occur within five years following timber harvest or where irreversible damage will occur because of timber harvest are also not suitable for timber production. All the remaining forested lands are tentatively suitable for timber production. The suitable and not suitable figures presented throughout this document are tentative until Forest Plans are approved.

Concepts Relating to the Alternatives Considered in Detail

1. For purposes of the spotted owl viability analysis, the capability to support pairs of owls estimated to be on lands tentatively not suitable for timber production was used as a constant across all alternatives. This capability, expressed as the potential number of pairs, is as follows:

National Park Service [1/]	Oregon and Washington	61
Bureau of Land Management,	Oregon	56
National Forests, Pacific Southwest Region,	California	195
National Forests, Pacific Northwest Region,	Ore/Wash	229
Total		541

[1/] Estimated in the viability analysis process used in this Supplement. (Refer to Appendix B.)

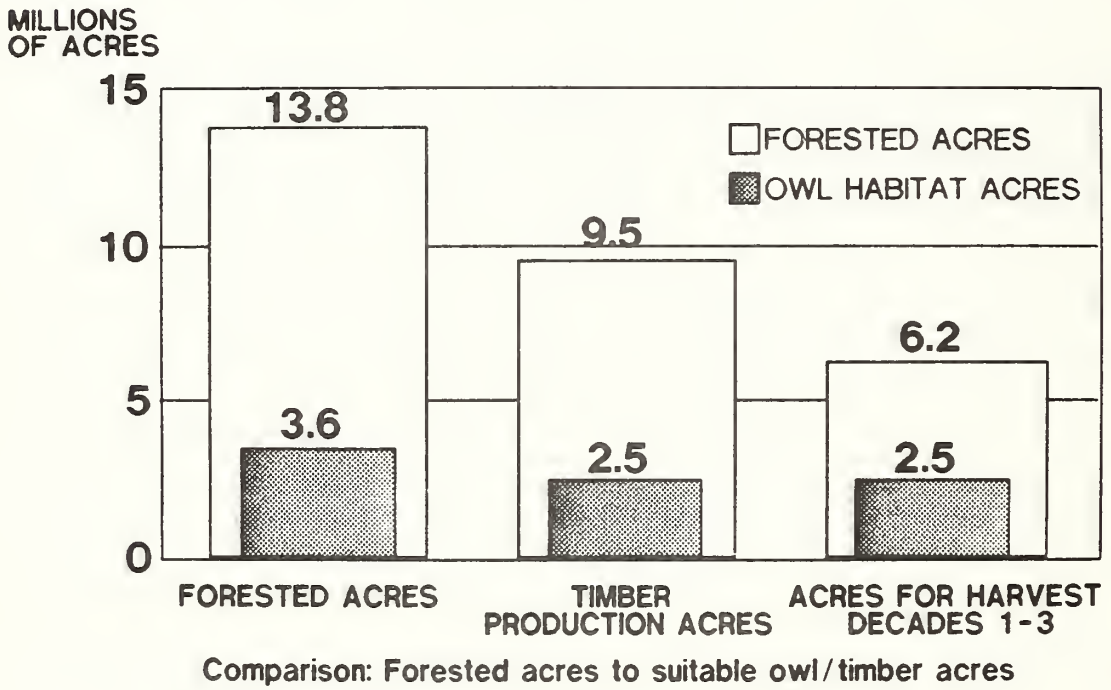


Figure 2-1. Forested Acres, by Condition, for the 13 National Forests with Spotted Owls

2. The different alternatives have been developed by varying the numbers and size of the spotted owl habitat areas on the 13 National Forests of the Pacific Northwest Region containing spotted owl habitat. The different numbers have been generated by varying the distance between habitat areas. Note the figure below.

3. Designated habitat areas displayed by alternatives means the number of habitat areas approximately located on maps or on the ground unless otherwise noted, such as in Alternative L. A clear picture of how this variation in distance between habitat areas was used to generate the numbers of designated habitat areas may become evident by using the Willamette National Forest as an example.

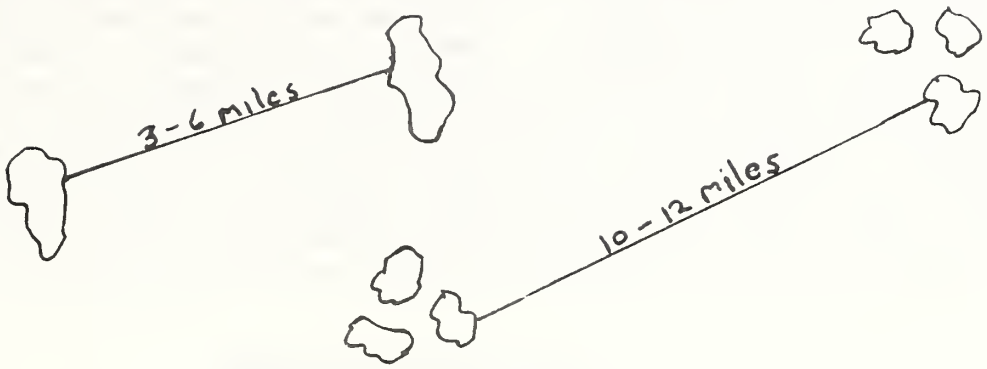


Figure 2-2. Habitat Distribution. Distances Between Habitat Areas and Clusters of Habitat Areas.

In the preferred alternative, Alternative F, the Willamette National Forest has 16 habitat areas designated on lands tentatively not suitable for timber production and 62 habitat areas designated on the lands tentatively suitable for timber production. These habitat areas were established throughout the forest using a network to ensure distribution of habitat (and, subsequently, owls) throughout the range of the spotted owl. The distances used in this network were approximately six miles between single habitat areas and approximately 12 miles between clusters of habitat areas. The sum of these designated habitat areas (16 + 62) is 78 which is the number of designated habitat areas on the Willamette National Forest in this alternative.

On the lands not suitable for timber production, there is additional suitable spotted owl habitat that will exist through time since no scheduled timber harvest will occur in these areas. This additional habitat can be found between the designated habitat areas and will contribute significantly to maintaining spotted owl viability. For the Willamette National Forest, this habitat has the capability to support 23 potential spotted owl pairs. This additional habitat, when added to the 16 areas designated on lands tentatively not suitable for timber production, brings the total for the purpose of viability analysis to 39 potential pairs. It is emphasized that these areas are, for the most part, unsurveyed for owl presence. Regionwide, these areas have the capability to support 229 potential pairs.

4. Some alternatives may require a regulation change to 36 CFR 219.19 to deal with the requirement to maintain a viable population well distributed throughout the planning area.

5. In all alternatives, the number of habitat areas displayed by forest are tentative estimates, and the actual number and location will be determined in the Forest planning process.. However, the Regional total will be approximately as stated in the alternative.

Alternative A: Provide no formal measures to protect the spotted owl. Under this alternative, the Forest Service would make no special land use designations for specifically managing spotted owl habitat. Spotted owl habitat would be retained on 1.1 million acres of National Forest land in the Pacific Northwest Region. These acres are either in a reserved catagory, such as wilderness, or have been determined to be not suitable for timber production for technical reasons. (Analysis of the Management Situation documents for the 13 National Forests in the Pacific Northwest Region.) On those lands tentatively suitable for timber production, there would be 2.1 million acres of suitable spotted owl habitat remaining by 1995. This figure was calculated by extending the current rate of harvest of spotted owl habitat, 40,000 acres per year, over the next ten years.

Alternative A at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	0
Gifford Pinchot	0
Mt. Baker-Snoq.	0
Mt. Hood	0
Okanogan	0
Olympic	0
Rogue River	0
Siskiyou	0
Siuslaw	0
Umpqua	0
Wenatchee	0
Willamette	0
Winema	0
Total	0

Since by definition in this alternative, no habitat areas would be designated, none are shown on the 1.1 million acres of lands not suitable for timber prodution. The capability of these areas was taken into account in the viability analysis as indicated on the previous page.

STANDARDS AND GUIDELINES

Mitigating Measures

Mitigating measures may include the addition of more habitat areas in the lands tentatively suitable for timber production at some later time. The

mitigating measure of transporting owls or eggs (demographic intervention) may also be used to overcome the adverse effects of isolating populations.

Alternative B: Provide habitat areas for spotted owls located in areas not suitable for timber production and provide dispersal habitats in a stepping-stone fashion to link these areas. Under this alternative, the Region would avoid isolating populations of spotted owls by providing islands of suitable spotted owl habitat to facilitate dispersal and connect the populations. These islands would consist of 300 acres of mature and old-growth forest, spaced no more than six miles apart.

Alternative B at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat on Lands Tentatively Suitable for Timber Production
Deschutes	0
Gifford Pinchot	0
Mt. Baker-Snoq.	19
Mt. Hood	17
Okanogan	0
Olympic	0
Rogue River	5
Siskiyou	29
Siuslaw	8
Umpqua	7
Wenatchee	1
Willamette	16
Winema	0
Total	102

Habitat in areas tentatively suitable for timber production is 24,897 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Areas to Link Habitat

   Habitat areas to link spotted owl populations in reserved lands shall be selected based on the following criteria, which are listed in order of priority.

   a. Highest priority shall be given to habitat areas that have suitable spotted owl habitat.

b. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas with capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Linking-habitat areas should be no more than six miles apart. A variance from these habitat spacing criteria may be granted by the Regional Forester if there is an opportunity to integrate the spacing of spotted owl habitat with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas suitable for timber production, linking-habitat areas shall be no less than 300 acres of suitable spotted owl habitat. If suitable habitat is unavailable, capable habitat may be used.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for the reduction in suitable owl habitat could include the designation of mature stands of timber to serve as additional areas should monitoring indicate they are needed. These areas would average 300 acres and would be selected to facilitate dispersal and to connect populations.

The mitigating measure of transporting owls or eggs (demographic intervention) may also be used to overcome the adverse effects of isolating populations.

Alternative C: Provide 417 habitat areas for spotted owls with each habitat area at least 300 acres in size. This is the no action alternative for management of spotted owl habitat in the National Forests of the Pacific Northwest Region. To the extent possible, each 300 acre habitat area should be a contiguous stand of mature or old-growth forest. In the original placement of these areas, 104 were located in lands not suitable for timber production. It should be noted that unlike this alternative, the current direction has no adjustment of the Allowable Sale Quantity for spotted owl habitat. The Allowable Sale Quantity that corresponds to this direction is found in Alternative A.

Alternative C at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	8
Gifford Pinchot	31
Mt. Baker-Snoq.	27
Mt. Hood	28
Okanogan	0
Olympic	13
Rogue River	33
Siskiyou	19
Siuslaw	20
Umpqua	38
Wenatchee	6
Willamette	75
Winema	15
Total	313

Habitat in areas tentatively suitable for timber production is 77,343 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters consisting of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted habitat, or both, do not fit the criteria for spacing habitat areas; or

b. If there is an opportunity to integrate spotted owl habitat with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas suitable and available for timber production, spotted owl habitat areas shall be no less than 300 acres of suitable habitat. This suitable habitat shall be provided within 1.5 miles of the known or suspected nesting site. If suitable habitat is unavailable, capable habitat may be used.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for the reduction in owl habitat could include the designation of mature and old-growth stands of timber to serve as additional habitat should monitoring indicate they are needed.

The mitigating measure of transporting owls or owl eggs (demographic intervention) may also be used to overcome the adverse effects of isolating populations.

Alternative D: Provide 550 habitat areas for spotted owls with each habitat area containing 1000 acres. This is the present planning direction for those 13 National Forests in the Pacific Northwest Region with spotted owls. To the extent possible, each 1000 acres should be a contiguous stand of mature or old-growth forest.

Alternative D at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	8
Gifford Pinchot	35
Mt. Baker-Snoq.	44
Mt. Hood	45
Okanogan	15
Olympic	24
Rogue River	24
Siskiyou	22
Siuslaw	25
Umpqua	38
Wenatchee	43
Willamette	62
Winema	7
Total	392

Habitat in areas tentatively suitable for timber production is 313,839 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

   Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

   a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

   b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters consisting of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the habitat spacing criteria; or

b. If there is an opportunity to integrate spotted owl habitats with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

Spotted owl habitat areas shall have at least 1000 acres of suitable habitat that is located within 1.5 miles of the known nest site or the center of the designated habitat area. A spotted owl habitat area may have more than 1000 acres of habitat in any combination of both suitable and capable habitat. Exceptions to this requirement may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no

adjustment in the calculation of the Allowable Sale Quantity for spotted owl habitat on lands suitable for timber production.

Mitigating measures for the reduction in owl habitat could include the designation of mature or old-growth stands of timber to serve as additonal habitat areas should monitoring indicate they are needed.

Alternative E: Provide 810 habitat areas for spotted owls with each habitat area containing 1000 acres. To the extent possible, the 1000 acres should be a contiguous stand of mature and old-growth forest.

Alternative E at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	8
Gifford Pinchot	55
Mt. Baker-Snoq.	47
Mt. Hood	61
Okanogan	11
Olympic	27
Rogue River	38
Siskiyou	45
Siuslaw	35
Umpqua	96
Wenatchee	47
Willamette	126
Winema	23
Total	619

Habitat in areas tentatively suitable for timber production is 509,779 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters consisting of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the habitat spacing criteria; or

b. If there is an opportunity to integrate spotted owl habitats with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

Spotted owl habitat areas shall have at least 1000 acres of suitable habitat that is located within 1.5 miles of the known nest site or the center of the designated habitat area. A spotted owl habitat area may have more than 1000 acres of habitat in any combination of both suitable and capable habitat. Exceptions to this requirement may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no adjustment in the calculation of the Allowable Sale Quantity for spotted owl habitat on lands suitable for timber production.

Mitigating measures for the reduction in owl habitat could include the designation of mature and old-growth timber to serve as additional habitat areas should monitoring indicate they are needed.

Alternative F: Provide at least 550 spotted owl habitat areas with a variable amount of suitable habitat. This is the preferred alternative. The intent is to maintain a viable population by protecting options for up to 2200 acres of suitable habitat per pair of owls, while minimizing effects on timber production during the first planning period of the National Forest Plans.

Alternative F at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Land Tentatively Suitable for Timber Production
Deschutes	8
Gifford Pinchot	35
Mt Baker-Snoq.	44
Mt. Hood	45
Okanogan	15
Olympic	24
Rogue River	24
Siskiyou	22
Siuslaw	25
Umpqua	38
Wenatchee	43
Willamette	62
Winema	7
Total	392

Habitat in areas suitable for timber production is between 313,839 and 690,446 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

The following guidelines will be used in planning for spotted owl habitat areas.

1. Designation of Spotted Owl Habitat Areas

   In order to protect existing pairs of owls:

   a. Highest priority will be given to areas with verified occupancy by spotted owls.

b. If there are an insufficient number of areas with verified occupancy, priority will be given to areas with confirmed use by spotted owls.

In order to minimize effects on timber production, habitat areas that are suitable for spotted owls will be designated to the greatest extent possible on lands that are classified as being unavailable or not suited for timber production.

2. Distribution or Spacing of Spotted Owl Habitat Areas

In order to provide for interaction of owls throughout the population, single designated habitat areas should not be more than six miles apart. Designated habitat areas may also be designated in clusters of three. The clusters, consisting of three designated habitat areas each, should be within approximately 12 miles of each other, as measured from edge to edge. The Regional Forester may permit exceptions to these standards in order to designate habitat areas where verified occupancy or confirmed use by spotted owls occurs. The Regional Forester may also permit exceptions to the distribution standards in order to designate habitat areas in suitable habitat with unconfirmed occupancy or use by owls if such an exception is needed to maintain the potential for a reasonable distribution of the species.

3. Conditions of Habitats Within Spotted Owl Habitat Areas

In order to meet the needs of each pair of owls, as well as to maintain options in case research and monitoring show that more than 1000 acres of habitat are needed for each pair or spotted owls, approximately 2200 acres of suitable habitat will be designated within 2.1 miles of the nest site or center of a designted habitat area. Under certain conditions, the amount of suitable habitat in each designated habitat area may vary.

a. Suitable habitat within a designated habitat area may exceed 2200 acres where:

(1) Designation of more acres is consistent with multiple-use objectives. Larger areas can also be designated where needed to prevent habitat loss from catastrophic events, or where there are physical barriers to dispersal, such as broad expanses of unsuitable habitat.

(2) Habitat is of lower than average quality. To support a pair of spotted owls, the designated habitat area may need to be larger, such as in the northern distribution of the subspecies.

b. Suitable habitat within a designated habitat area may be less than 2200 acres where:

(1) The area having less than 2200 acres of habitat has had verified occupancy by owls within the previous two years, and

the amount and quality of suitable habitat has not declined significantly within the pair's home range during the previous two years.

(2) There is currently insufficient suitable habitat within 2.1 miles of the known nesting site or the center of the designated area to provide 2200 acres.

(3) Where habitat is of higher than average quality.

4. Management of Spotted Owl Habitat Areas

Where silvicultural treatment is appropriate and consistent with habitat suitability for spotted owls, designated habitat areas shall be classed as suitable timber producing land if they have not been declared unsuitable for other reasons.

5. Consideration of Suitable Habitats in Calculating Allowable Sale Quantities

Up to 1000 acres, the land area within each designated habitat area will be excluded from the suitable land base used to determine the allowable sale quantity of timber. If a designated habitat area is larger than 1000 acres, the amount of land in excess of 1000 acres shall be included in calculating the allowable sale quantity for the Forest Plan.

Timber sales will not be scheduled in designated habitat areas during the normal ten to 15 year life of the Forest Plan. If this is not possible, then further adjustment in allowable sale quantity (beyond the 1000 acres) may be made upon approval of the Regional Forester.

Alternative G: Provide 550 habitat areas for spotted owls with habitat areas averaging 2200 acres. To the extent possible, each habitat area should be a contiguous stand of mature or old-growth forest.

Alternative G at A Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	8
Gifford Pinchot	35
Mt. Baker-Snoq.	44
Mt. Hood	45
Okanogan	15
Olympic	24
Rogue River	24
Siskiyou	22
Siuslaw	25
Umpqua	38
Wenatchee	43
Willamette	62
Winema	7
Total	392

Habitat in areas tentatively suitable for timber production is 690,446 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the criteria for spacing habitat areas; or

b. If there is an opportunity to integrate spotted owl habitats with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas that are suitable and available for timber production, spotted owl habitat areas shall average 2200 acres of suitable habitat. These acres are to be located within 1.8 miles of the known nest site or the center of the designated habitat area. The sizes of individual habitat areas may vary by 10 percent from the forest average of 2200 acres. With the approval of the Forest Supervisor, exceptions to the requirement that habitat areas shall be between 1000 and 3800 acres may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient suitable habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

c. Under conditions (a) and (b), capable habitat will not be included in the forest-wide average of 2200 acres for spotted owl habitat areas, except through approval by the Forest Supervisor.

Spotted owl habitat areas larger than the average should generally be provided where:

(1) Habitat suitablility for spotted owls has a lower potential, considering the range of suitability for the region. Such is the case in the northern distribution of the subspecies; or

(2) Designation of more acres is consistent with and will not limit the achievement of other land management objectives, including that of timber management; or

(3) Habitat losses from windstorms are likely; or

(4) There are physical barriers to dispersal beyond the designated habitat area, such as broad expanses of unsuitable habitat.

Spotted owl habitat areas smaller than the average may be provided where:

(1) Breeding success within the previous two years has been documented and a stable amount of suitable habitat was available during this period; and

(2) There is currently insufficient suitable habitat within 1.8 miles of the known nesting site or the center of the designated area to meet the average size for habitat areas.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no adjustment in the calculation of the Allowable Sale Quantity for owl habitat areas on lands suitable for timber production.

Mitigating measures for the reduction in owl habitat could include the designation of mature stands of timber to serve as additional habitat should monitoring indicate they are needed.

Alternative H: Provide 620 habitat areas for spotted owls with habitat areas averaging 2200 acres in Oregon and 4200 acres in Washington. To the extent possible, the habitat should consist of mature and old-growth forest.

Alternative H at A Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	8
Gifford Pinchot	35
Mt. Baker-Snoq.	44
Mt. Hood	45
Okanogan	15
Olympic	24
Rogue River	24
Siskiyou	22
Siuslaw	25
Umpqua	38
Wenatchee	43
Willamette	62
Winema	7
Total	392

Habitat in areas tentatively suitable for timber production is 948,246 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the criteria for spacing habitat areas; or

b. If there is an opportunity to integrate spotted owl habitats with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas that are suitable and available for timber production, spotted owl habitat areas shall average 2200 acres of suitable habitat on National Forests in Oregon and 4200 acres of suitable habitat on National Forests in Washington. These acres are to be located within 1.8 miles of the known nest site or the center of the designated habitat area. The sizes of individual habitat areas may vary by 10 percent from the forest average of 2200 acres in Oregon and 4200 acres in Washington. The sizes of individual habitat areas may vary even further upon approval by the Forest Supervisor, provided they are no less than 1000 acres and no greater than 3800 acres in Oregon and 4600 acres in Washington of suitable habitat. With the approval of the Forest Supervisor, exceptions to the requirement that habitat areas shall be between 1000 and 3800 acres in Oregon and 1000 and 4600 acres in Washington may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient suitable habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

c. Under conditions (a) and (b), capable habitat will not be included in the forest-wide average of 2200 or 4200 acres for spotted owl habitat areas, except through approval by the Forest Supervisor.

Spotted owl habitat areas larger than the average should generally be provided where:

(1) Habitat suitablility for spotted owls has a lower potential, considering the range of suitability for the region. Such is the case in the northern distribution of the subspecies; or

(2) Designation of more acres is consistent with and will not limit the achievement of other land management objectives, including that of timber management; or

(3) Habitat losses from windstorms are likely; or

(4) There are physical barriers to dispersal beyond the designated habitat area, such as broad expanses of unsuitable habitat.

Spotted owl habitat areas smaller than the average may be provided where:

(1) Breeding success within the previous two years has been documented and a stable amount of suitable habitat was available during this period; and

(2) There is currently insufficient suitable habitat within 1.8 miles of the known nesting site or the center of the designated area to meet the average size for habitat areas.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no adjustment in the calculation of the Allowable Sale Quantity for owl habitat areas on lands suitable for timber production.

Mitigating measures for the reduction in owl habitat could include the designation of mature stands of timber to serve as additional habitat should monitoring indicate they are needed.

Alternative I: Provide 797 habitat areas for spotted owls in clusters of three areas each. Each cluster of three habitats will be 6600 acres. To the extent possible, the habitat should be contiguous stands of mature or old-growth forest. The clusters should be no more than 12 miles apart.

Alternative I at A Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	18
Gifford Pinchot	68
Mt. Baker-Snoq.	72
Mt. Hood	61
Okanogan	26
Olympic	44
Rogue River	35
Siskiyou	47
Siuslaw	45
Umpqua	56
Wenatchee	73
Willamette	75
Winema	19
Total	639

Habitat in areas tentatively suitable for timber production is 1,120,306 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters of three spotted owl habitat areas each should be no more than 12 miles apart. A variance from this criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the criteria for spacing habitat areas; or

b. If there is an opportunity to integrate spotted owl habitats with other compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas that are suitable and available for timber production, spotted owl habitat areas shall average 2200 acres of suitable habitat. These acres are to be located within 1.8 miles of the known nest site or the center of the designated core area. The sizes of individual habitat areas may vary by 10 percent from the forest average of 2200 acres. The sizes of individual habitat areas may vary even further upon approval by the Forest Supervisor, provided they are no less than 1000 acres and no greater than 3800 acres of suitable habitat. With the approval of the Forest Supervisor, exceptions to the requirement that habitat areas shall be between 1000 and 3800 acres may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient suitable habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

c. Under conditions (a) and (b), capable habitat will not be included in the forest-wide average of 2200 acres for spotted owl habitat areas, except through approval by the Forest Supervisor.

Spotted owl habitat areas larger than the average should generally be provided where:

(1) Habitat suitablility for spotted owls has a lower potential, considering the range of suitability for the region. Such is the case in the northern distribution of the subspecies; or

(2) Designation of more acres is consistent with and will not limit the achievement of other land management objectives, including that of timber management; or

(3) Habitat losses from windstorms are likely; or

(4) There are physical barriers to dispersal beyond the designated habitat area, such as broad expanses of unsuitable habitat.

Spotted owl habitat areas smaller than the average may be provided where:

(1) Breeding success within the previous two years has been documented and a stable amount of suitable habitat was available during this period; and

(2) There is currently insufficient suitable habitat within 1.8 miles of the known nesting site or the center of the designated core area to meet the average size for habitat areas.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no adjustment in the calculation of the Allowable Sale Quantity for owl habitat areas on lands suitable for timber production.

Mitigating measures for the reduction in owl habitat could include the designation of mature stands of timber to serve as additional habitat should monitoring indicate they are needed.

Alternative J: Provide 1000 habitat areas for spotted owls with habitat areas averaging 2200 acres. To the extent possible, the habitat should be contiguous stands of mature or old-growth forests.

Alternative J at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	11
Gifford Pinchot	76
Mt. Baker-Snoq.	68
Mt. Hood	84
Okanogan	19
Olympic	54
Rogue River	44
Siskiyou	52
Siuslaw	42
Umpqua	96
Wenatchee	75
Willamette	128
Winema	32
Total	781

Habitat in areas tentatively suitable for timber production is 1,390,366 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the criteria for spacing habitat areas; or

b. If there is an opportunity to integrate spotted owl habitats with compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas that are suitable and available for timber production, spotted owl habitat areas shall average 2200 acres of suitable habitat. These acres are to be located within 1.8 miles of the known nest site or the center of the designated core area. The sizes of individual habitat areas may vary by 10 percent from the forest average of 2200 acres. The sizes of individual habitat areas may vary even further upon approval by the Forest Supervisor, provided they are no less than 1000 acres and no greater than 3800 acres of suitable habitat. With the approval of the Forest Supervisor, exceptions to the requirement that habitat areas shall be between 1000 and 3800 acres may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient suitable habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

c. Under conditions (a) and (b), capable habitat will not be included in the forest-wide average of 2200 acres for spotted owl habitat areas, except through approval by the Forest Supervisor.

Spotted owl habitat areas larger than the average should generally be provided where:

(1) Habitat suitability for spotted owls has a lower potential, considering the range of suitability for the region. Such is the case in the northern distribution of the subspecies; or

(2) Designation of more acres is consistent with and will not limit the achievement of other land management objectives, including that of timber management; or

(3) Habitat losses from windstorms are likely; or

(4) There are physical barriers to dispersal beyond the designated habitat area, such as broad expanses of unsuitable habitat.

Spotted owl habitat areas smaller than the average may be provided where:

(1) Breeding success within the previous two years has been documented and a stable amount of suitable habitat was available during this period; and

(2) There is currently insufficient suitable habitat within 1.8 miles of the known nesting site or the center of the designated core area to meet the average size for habitat areas.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no adjustment in the calculation of the Allowable Sale Quantity for owl habitat on lands suitable for timber production.

Mitigating measures for the reduction in owl habitat could include the designation of mature stands of timber if monitoring indicates they are needed.

Alternative K: Provide 1000 habitat areas for spotted owls with habitat areas averaging 2900 acres. To the extent possible, the habitat should consist of mature and old-growth forest.

Alternative K at a Glance

Estimated Habitat for Spotted Owls by National Forest

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	11
Gifford Pinchot	76
Mt. Baker-Snoq.	68
Mt. Hood	84
Okanogan	19
Olympic	54
Rogue River	44
Siskiyou	52
Siuslaw	42
Umpqua	96
Wenatchee	75
Willamette	128
Winema	32
Total	781

Habitat in areas tentatively suitable for timber production is 1,837,211 acres.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Identification and Selection of Spotted Owl Habitat Areas

Spotted owl habitat areas shall be selected based on the following criteria, listed in order of priority.

a. Highest priority shall be given to habitat areas that have verified spotted owl pairs.

b. If there are insufficient areas with verified spotted owl pairs, the next priority shall be given to habitat areas with confirmed use by spotted owls.

c. If there are insufficient areas with confirmed use by spotted owls, the next priority shall be given to areas with suitable spotted owl habitat.

d. If there are insufficient areas with suitable spotted owl habitat, the next priority shall be given to areas of capable spotted owl habitat.

2. Distribution or Spacing of Spotted Owl Habitat Areas

Clusters of three spotted owl habitat areas each should be no more than 12 miles apart. Single spotted owl habitat areas should be no more than six miles apart. A variance from these criteria for spacing habitat areas may be granted by the Regional Forester for the following reasons:

a. If the location of a verified owl pair, or an area of suitable spotted owl habitat, or both, do not fit the criteria for spacing habitat areas; or

b. If there is an opportunity to integrate spotted owl habitats with compatible land uses.

3. Size of Spotted Owl Habitat Areas

In areas that are suitable and available for timber production, spotted owl habitat areas shall average 2900 acres of suitable habitat. These acres are to be located within 1.8 miles of the known nest site or the center of the designated habitat area. The sizes of individual habitat areas may vary by 10 percent from the forest average of 2900 acres. The sizes of individual habitat areas may vary even further upon approval by the Forest Supervisor, provided they are no less than 1000 acres and no greater than 3800 acres of suitable habitat. With the approval of the Forest Supervisor, exceptions to the requirement that habitat areas shall be between 1000 and 3800 acres may be permitted under the following circumstances:

a. A habitat area may have fewer than 1000 acres of suitable habitat if it has been occupied by a breeding pair of owls over the previous two years and enough capable spotted owl habitat has been added to bring the total of suitable and capable habitat to 1000 acres.

b. A habitat area may have fewer than 1000 acres of suitable habitat if it is used to meet the spacing requirement in criterion number 2 and if there is insufficient suitable habitat to provide 1000 acres. In such a case, capable habitat shall be added to bring the total acres in the habitat area to at least 1000.

c. Under conditions (a) and (b), capable habitat will not be included in the forest-wide average of 2900 acres for spotted owl habitat areas, except through approval by the Forest Supervisor.

Spotted owl habitat areas larger than the average should generally be provided where:

(1) Habitat suitability for spotted owls has a lower potential, considering the range of suitability for the region. Such is the case in the northern distribution of the subspecies; or

(2) Designation of more acres is consistent with and will not limit the achievement of other land management objectives, including that of timber management; or

(3) Habitat losses from windstorms are likely; or

(4) There are physical barriers to dispersal beyond the designated habitat area, such as broad expanses of unsuitable habitat.

Spotted owl habitat areas smaller than the average may be provided where:

(1) Breeding success within the previous two years has been documented and a stable amount of suitable habitat was available during this period; and

(2) There is currently insufficient suitable habitat within 1.8 miles of the known nesting site or the center of the designated habitat area to meet the average size for habitat areas.

4. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Mitigating Measures

Mitigating measures for declining timber outputs could include making no adjustment in the calculation of the Allowable Sale Quantity for owl habitat on lands suitable for timber management.

Mitigating measures for the reduction in owl habitat could include the designation of mature stands of timber if monitoring indicates they are needed.

Alternative L: Provide for no further reduction in spotted owl habitat and, in addition, select areas capable of growing into a suitable habitat condition. Under this alternative, approximately 200,000 acres of capable habitat[1/] would be added to the areas already in a suitable habitat condition. This alternative would improve the distribution of spotted owl habitat on the National Forests of the Pacific Northwest Region compared to the present situation.

Alternative L at a Glance

Estimated Habitat for Spotted Owls by National Forest[2/]

National Forest	Habitat Areas on Lands Tentatively Suitable for Timber Production
Deschutes	9
Gifford Pinchot	204
Mt. Baker-Snoq.	126
Mt. Hood	116
Okanogan	7
Olympic	65
Rogue River	44
Siskiyou	135
Siuslaw	68
Umpqua	163
Wenatchee	41
Willamette	221
Winema	21
Total	1220

Habitat in areas tentatively suitable for timber production is 2,618,125 acres.

1/ See Appendix B for a discussion of capable owl habitat.

2/ The number of possible habitat areas is derived by dividing the total number of acres of suitable spotted owl habitat by 2200.

STANDARDS AND GUIDELINES

Implementation Criteria

1. Management of Spotted Owl Habitat

Spotted owl habitat can be provided by dedication of an area or by the use of silvicultural management. Selection of the means for providing spotted owl habitat will depend on a site-specific determination.

Table 2-1

Estimated Spotted Owl Habitat Areas in Lands Suitable and Available for Timber Management.

National Forest	Alternatives											
	A	B	C*	D	E	F**	G	H	I	J	K	L
Deschutes	0	0	8	8	8	8	8	8	18	11	11	9
Gifford Pinchot	0	0	31	35	55	35	35	35	68	76	76	204
Mt. Bak/Snoq.	0	19	27	44	47	44	44	44	72	68	68	126
Mt. Hood	0	17	28	45	61	45	45	45	61	84	84	116
Okanogan	0	0	0	15	11	15	15	15	26	19	19	7
Olympic	0	0	13	24	27	24	24	24	44	54	54	65
Rogue River	0	5	33	24	38	24	24	24	35	44	44	44
Siskiyou	0	29	19	22	45	22	22	22	47	52	52	135
Siuslaw	0	8	20	25	35	25	25	25	45	42	42	68
Umpqua	0	7	38	38	96	38	38	38	56	96	96	163
Wenatchee	0	1	6	43	47	43	43	43	73	75	75	41
Willamette	0	16	75	62	126	62	62	62	75	128	128	221
Winema	0	0	15	7	23	7	7	7	19	32	32	21
Total	0	102	313	392	619	392	392	392	639	781	781	1220

*No Action Alternative **Preferred Alternative

Table 2-2

Comparison of Alternatives by Number [1/] and Average Size of Habitat Areas in Lands Suitable and Available for Timber Management

	Alternatives											
	A	B	C*	D	E	F**	G	H	I	J	K	L
Number Areas	0	102	313	392	619	392	392	392	639	781	781	1220 [2/]
Average Size	0	300	300	1000	1000	1000-2200	2200	Ore. 2200 Wash. 4200	2200	2200	2900	--

*No Action Alternative **Preferred Alternative

[1/] In addition, the estimated capacity to support pairs of owls on lands not suited for timber production is 229 areas.

[2/] Estimated by dividing habitat acres by 2200.

COMPARISON OF ALTERNATIVES, EFFECTS ON NORTHERN SPOTTED OWLS

Viability Analysis Summaries

The tables on the following pages present information on how well each alternative provides for the viability of the northern spotted owl population. This determination was based on a synthesis of existing data and the results of modeling efforts. The major items considered in making the determination were projections of the amount and distribution of suitable habitat over time, estimates of the capability of that habitat to support breeding pairs of owls, and projections of genetic and demographic risks to the owl population. A table is presented for each subpopulation that expresses the likelihood that a well-distributed population will be present in the planning area at any future time. This likelihood is expressed according to the following five classifications:

VERY HIGH (VH): Continued existence of a well-distributed population on the planning area at the future date is virtually assured. There is latitude for catastrophic events within the population or for findings that the species is less adaptable or that demographic or genetic factors are more significant than assumed in planning.

HIGH (H): There is a high likelihood of continued existence of a well-distributed population on the planning area at the future date. There is limited latitude for catastrophic events within the population or for biological findings that planning assumptions were in error.

MODERATE (M): There is a moderate likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic events, random demographic events, or genetic deterioration could result in extirpation of the species from major parts of its geographic range.

LOW (L): There is a low likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic events, random demographic events, or genetic deterioration are likely to cause extirpation of the species from major parts or all of its geographic range.

VERY LOW (VL): There is a very low likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic events, random demographic events, or genetic deterioration are highly likely to cause extirpation of the species from major parts or all of its geographic range.

The spotted owls on the Olympic Peninsula may be an isolated population, and were considered in that light in all alternatives. Isolation of populations may also occur along the Columbia River Gorge. The effects of this isolation were examined, first, by considering the Gorge as if it were a barrier to dispersal and, second, by considering the Gorge as if it were not a barrier. In the first case, the Washington Cascades population was treated as an isolate, and the populations in the Oregon Cascades, the Oregon Coast Range, and the Klamath Province were treated as a single

unit. When the Gorge is not considered to be a barrier, these Oregon populations and the Washington Cascades population are combined.

The final question concerning isolation occurs with the Coast Range population in Alternatives A and B. In these two alternatives, the Coast Range population is projected to split off as an isolate and the results for that population are shown separately. All of these assesments are based on estimated demographic, genetic, and distribution effects absent of changes in management that could result from monitoring and research.

Adaptive management changes to counter major threats to the population to reduce risks could hold the probabilities of continued existence higher than indicated in these tables, providing the population number and distribution have not fallen to such a low level that the species is unable to respond to management.

Table 2-3

Summary of Projected Probabilities of Persistence and Levels of Protection by Alternative[1/]

Olympic Peninsula

Alternative	Probability of persistence of well-distributed population by year				
	15[2/]	50	100	150	500
A	M	L	VL	VL	VL
B	M	L	VL	VL	VL
C*	H	L	VL	VL	VL
D	H	M	L	L	VL
E	H	M	L	L	VL
F**	H	M	L	L	VL
G	H	M	L	L	VL
H	H	M	M	L	VL
I	H	H	M	M	L
J	H	H	M	M	L
K	H	H	M	M	L
L	VH	H	M	M	L

*No Action Alternative **Preferred Alternative

1/ See "Probability of Persistence" in Chapter 4 for an explanation and definition of this table.

2/ Period of Forest Plans.

Table 2-3 (Continued)

Summary of Projected Probabilities of Persistence and Levels or Protection by Alternative[1/]

Washington Cascades
(Assumes Columbia River Gorge is a Barrier)

Probability of persistence of well-distributed population by year

Alternative	15[2/]	50	100	150	500
A	M	L	VL	VL	VL
B	M	L	VL	VL	VL
C*	H	L	L	VL	VL
D	H	M	L	L	VL
E	H	M	M	L	L
F**[3/]	H	M	M-L	L	L-VL
G	H	M	M	L	L
H	H	H	M	M	L
I	H	H	M	M	L
J	H	H	M	M	L
K	H	H	H	M	L
L	VH	H	H	H	M

*No Action Alternative **Preferred Alternative

[1/] See "Probability of Persistence" in Chapter 4 for an explanation and definition of this table.

[2/] Period of Forest Plans.

[3/] Some values are shown as ranges because this alternative maintains the option to provide either 1000-acre or 2200-acre habitat areas after the first decade.

Table 2-3 (Continued)

Summary of Projected Probabilities of Persistence and Levels of Protection by Alternative[1/]

Oregon Cascades, Klamath, and Coast Range
(Assumes Columbia River Gorge is a Barrier)

Probability of persistence of well-distributed population by year

Alternative	15[2/]	50	100	150	500
A	M	L[3/]	VL[3/]	VL[3/]	VL[3/]
B	M	L[3/]	VL[3/]	VL[3/]	VL[3/]
C*	H	L	L	VL	VL
D	H	M	L	L	VL
E	H	M	M	L	L
F**[4/]	H	M	M-L	L	L-VL
G	H	M	M	M	L
H	H	M	M	M	L
I	H	H	M	M	L
J	VH	H	H	M	L
K	VH	H	H	M	L
L	VH	VH	H	H	M
Alternative		**Coast Range**			
A		L	VL	VL	VL
B		L	VL	VL	VL

*No Action Alternative **Preferred Alternative

1/ See "Probability of Persistence" in Chapter 4 for an explanation and definition of this table.

2/ Period of Forest Plans.

3/ Oregon Cascades and Klamath areas only (Coast Range becomes isolated, as shown at bottom of chart).

4/ Some values are shown as ranges because this alternative maintains the option to provide either 1000-acre or 2200-acre habitat areas after the first decade.

Table 2-3 (Continued)

Summary of Projected Probabilities of Persistence and Levels of Protection by Alternative[1/]

Washington Cascades, Oregon Cascades, Klamath, and Coast Range
(Assumes Columbia River Gorge Is Not a Barrier)

Probability of persistence of well-distributed population by year

Alternative	15[2/]		50	100	150	500
A	M		L[3/]	VL[3/]	VL[3/]	VL[3/]
B	M		L[3/]	VL[3/]	VL[3/]	VL[3/]
C*	H		L	L	VL	VL
D	H		M	L	L	VL
E	H		M	M	L	L
F**[4/]	H		H-M	M-L	L	L-VL
G	H		H	M	M	L
H	H		H	M	M	L
I	H		H	M	M	L
J	H		H	H	M	L
K	H		H	H	M	L
L	VH		VH	H	H	M
Alternative			Coast Range			
A			L	VL	VL	VL
B			L	VL	VL	VL

*No Action Alternative **Preferred Alternative

1/ See "Probability of Persistence" in Chapter 4 for an explanation and definition of this table.

2/ Period of Forest Plans.

3/ Washington Cascades, Oregon Cascades and Klamath areas only. Coast Range becomes isolated, as shown at bottom of chart.

4/ Some values are presented as a range because this alternative maintains the option to provide either 1000-acre or 2200-acre habitat areas after the first decade.

Table 2-4

Features of Each Alternative
For Region Six Forests

Alt.	Total Owl Habitat (acres)	Owl Habitat Area Size (acres)	Owl Dispersal Provisions (miles)	No. Habitat Areas (each)	Habitat In Suit. Timber (acres)
A	1,100,000	--	--	--	--
B	1,130,600	300	6-12	102	24,897
C*	1,193,900	300	6-12	417	77,343
D	1,492,000	1000	6-12	550	313,839
E	1,719,000	1000	6-12	810	509,779
F**	1,492,000-1,962,400	1000-2200	6-12	550	313,839-690,446
G	1,92,400	2200	6-12	550	690,446
H	2,462,400	2200-OR 4200-WA	6-12	620	948,246
I	2,405,800	6600	4-12	797	1,120,306
J	2,818,200	2200	3-12	1000	1,390,366
K	3,335,900	2900	3-12	1000	1,837,211
L	3,783,703	--	--	1400	2,618,125

*No Action Alternative **Preferred Alternative

Table 2-5

Predicted Capability to Support Pairs of Northern Spotted Owls on National Forests in Washington and Oregon Under Each of the Alternatives[1/]

Alternative	Year 0	15	50	100	150
A	1248	832	359	262	257
B	1248	836	369	274	268
C*	1248	859	400	315	300
D	1248	917	501	435	409
E	1248	953	575	518	499
F**[2/]	1248	929	501-592	435-538	409-524
G	1248	952	605	567	572
H	1248	955	616	585	605
I	1248	1039	752	749	765
J	1248	1095	864	863	891
K	1248	1100	947	1026	1031
L	1248	1248	1248	1294	1294

*No action alternative **Preferred alternative

[1/] Predictions of habitat capability in this table and the following tables are based on suitable habitat located on National Forests that fall into one of the following catagories: (1) lands that are designated to be managed for spotted owl habitat; (2) lands that are reserved from timber harvest; (3) lands that are scheduled for timber harvest but will not have been harvested at the specified date; and (4) lands that are technically not suitable for timber harvest.

[2/] Some values are presented as a range because this alternative maintains the option to provide either 1000-acre to 2200-acre habitat areas after the first decade.

Table 2-6

Comparison of Alternatives
Effects on Timber[1/]

Alternatives	Changes in 1st Decade Timber Harvest (in % only)
Alternative B percent	-0.4
Alternative C (No Action Alternative) percent	-1.3
Alternative D percent	-5.0
Alternative E percent	-8.5
Alternative F (Preferred Alternative) percent	-5.0
Alternative G percent	-11.7
Alternative H percent	-15.3
Alternative I percent	-18.2
Alternative J percent	-24.9
Alternative K percent	-32.8
Alternative L percent	-46.7

[1/] Values are expressed as changes from Alternative A.

ECONOMIC AND EMPLOYMENT EFFECTS

The immediate consequence of providing increased protection for spotted owls is to reduce timber harvests. Such reductions would have undesirable economic and employment effects. Reductions in harvests to preserve owl habitat are not expected to result in significantly higher levels of other kinds of activities generating employment, such as recreation. With local exceptions for specialized kinds of recreation, the Region has more than enough capacity to meet projected increases in recreational uses. Any offsetting, desirable economic and employment effects would be minor. The following effects are expected to result from decreased harvests at the Regional level. These effects are more fully discussed, and are defined at sub-Regional levels, in Chapter 4. (Technical procedures and assumptions are discussed in Appendix H.)

The principal economic and employment effects are displayed in Table 2-7. All of these effects are directly proportional to reductions in harvest levels that result from varying the acreage and distribution of spotted owl habitat. In turn, reductions in harvest levels are proportional to reductions in the land base available to support timber production, except for Alternative F. In this alternative, the same spotted owl habitat as in Alternative G would be preserved but reductions in harvest during the planning period would be the same as in Alternative D, which provides less habitat. It is assumed that the suitable land base of Alternative D is available for timber production when determining levels of harvest. This would lead to a harvest during the planning period under Alternative F that is identical to Alternative D. If, after the current planning period, it is decided to continue a level of protection provided by Alternative F, there would result decreased harvests to somewhat lower than the level in Alternative G and further decreases in employment and economic values. This pattern of harvest is reflected in estimates of present net value, which compare costs of management to timber receipts over the next 50 years, in Table 4-22 of Chapter 4. The accompanying discussion points out that constant levels of timber harvests for 50 years are projected for the other alternatives, assuming the planning period decision is extended in the future for that longer period.

Private sector and Forest Service employment reductions are calculated as six logging plus wood processing jobs and one job per million board feet, respectively. (About half the reductions in National Forest costs would be due to savings assocated with laid off Federal employees.)

In addition to these direct affects, other jobs would be affected through the "multiplier effect." Because estimates of these non-direct jobs are less reliable they are not included in the table. They can be roughly estimated by multiplying the displayed estimates by 2.6.

Net cash flows of government were calculated as:

US Treasury net cash flows
= (National Forest timber receipts) - (National Forest costs)
+ (federal tax receipts) - (payments to counties)

Table 2-7

Average Annual Reductions in Harvests from Base Alternative A and Consequent Reductions in Direct Employment and in Government Net Cash Flows During the Planning Period[1/]

Alt.	Direct Employment: Private Sector	Direct Employment: Forest Service	US Treasury Cash Flows from Region: Net Flow	US Treasury Cash Flows from Region: National Forests: Receipts	US Treasury Cash Flows from Region: National Forests: Costs	US Treasury Cash Flows from Region: Federal Taxes	Payments to Counties	State Cash Flows: Net Flow	State Cash Flows: State Taxes
	------No. Jobs-------		----------Million Dollars----------						
B	0[2/]	15	1	3	1	0	1	1	0
C	0[2/]	50	4	9	3	0	3	3	0
D	570-1140	190	18- 21	33	10	4- 7	9	10- 11	1- 2
F	570-1140	190	18- 21	33	10	4- 7	9	10- 11	1- 2
E	970-1940	320	31- 38	57	17	7-13	15	17- 19	2- 3
G	1330-2660	440	42- 50	77	24	9-17	21	23- 25	3- 5
H	1740-3480	580	51- 62	96	31	12-23	26	29- 32	3- 6
I	2100-4200	700	65- 78	120	37	14-28	32	36- 40	4- 8
J	2830-5660	940	88-106	163	50	20-37	44	49- 54	6-10
K	3735-7470	1240	117-140	214	66	26-49	58	65- 71	7-14
L	5415-10830	1800	172-206	317	96	37-71	86	97-105	11-20

[1/] Low estimate assumes 50 percent offset of National Forest harvest reductions by other ownerships. High estimate assumes no offset. See text for interpretation of estimates.

[2/] Relatively small volume reductions when distributed among processing areas probably would not affect private sector employment. Employment in the Forest Products Industry in 1984 was about 82,500.

State net cash flows
= (state tax receipts) + (payments to counties)

Excluded from the displayed estimates are direct costs to Federal, state, and local governments associated with unemployment and any reductions in state and county government employment that might result from decreased revenues. Currently, newly unemployed workers draw workman's compensation for an average of about 15 weeks; in the recession year 1981, the average approached 22 weeks. Workman's compensation funds usually come from a combination of the businesses laying off the workers and the states. In 1981, they were supplemented with Federal funds. (Other, more subtle and less direct costs to society of unemployment have also been excluded.)

As a consequence of these types of exclusions, the estimates of effects are probably understated if they are viewed only in the context of that portion of the economy directly dependent upon the forest products industry. However, the portion of workers discharged from the forest products industry who would move or find other kinds of employment in the Region or both is unknown. This is primarily determined by the much broader conditions in the general economy; by conditions that may or may not be similar to the wood products industry environment. Therefore, the displayed negative effects may not be satisfactory approximations of net losses to the total Regional economy.

Interpreting the estimates of reductions in tax payments requires similar caution. They are simplistic estimates because they do not allow for compensating changes within the state, region, or nation. For example, if there were a reduction in wood products produced by the region, we could expect offsetting activities elsewhere in the form of increased harvest and imports and, perhaps, increased production of non-wood substitute products. Such activities would reduce the displayed estimates of "lost" Federal tax payment.

The ranges of effects shown were calculated on the assumptions that (1) 50 percent of National Forest harvest decreases would be offset by other ownerships, and (2) there would be no offsets. Any offsets would have to come from diversions to domestic processing of some portions of the 3 billion board feet of logs now exported or from increased harvests on non-National Forest lands or both. In order for export logs to be diverted, the relatively large premiums in price currently paid for exported logs would have to be offset by increases in prices paid for logs processed domestically. Based on informal assessments of current inventories of merchantable timber on non-National Forest lands in the Region, there appear to be only limited opportunities for increases in harvests that could be sustained over the planning period, particularly in those areas where the greatest reductions in National Forest harvests would occur, such as western Oregon. Certainly, near-term inventories available for harvesting will be less than often assumed ten years ago to support projections of harvest levels. To avoid making speculative adjustments to such projections, ranges -- probably including both too-high and too-low extremes -- are presented. (See the in-depth discussion of effects on the timber resource in Chapter 4.)

The resulting ranges of estimated effects are probably broad enough to account both for possible offsets of log flows and for inaccuracies in the estimates of employment and economic consequences. It is likely that the larger estimates of effects are most appropriate for alternatives which would lead to the largest reductions in harvests.

Table 2-8 summarizes tradeoffs between protection for the spotted owl and direct employment during the planning period. While it is true that the survival of the owl depends upon actions over a much longer time, the current choice among alternatives is only for the next ten to 15 years in the planning period. Habitat capability at the end of this period will define the maximum number of owls that can be supported in future decades and may limit the options for future decisions. To the extent that the precise distributions of habitat (that must be defined on a forest-by-forest basis) or other considerations not reflected in the "number of pairs of owls" are important, this table is misleading.

Table 2-8

Tradeoffs During the Planning Period Between Increases in Protection for Spotted Owls Beyond Alternative A and Reductions in Direct Employment[1/]

Alt.	End of planning period habitat capability		Total decrease in direct employment		Decrease in direct employment per additional pair of owls increase[2/]	
	Total	Increase	50% offset	No offset	50% offset	No offset
	---pairs of owls---		---------- No. of Jobs ----------			
B	836	4	15	15	4	4
C	859	27	50	50	2	2
D	917	85	765	1340	9	16
E	953	121	1290	2260	11	19
F	929	97	765	1340	8	14
G	952	120	1770	3100	15	26
H	955	123	2320	4060	19	33
I	1,039	207	2795	4890	14	24
J	1,095	263	3775	6610	14	25
K	1,100	268	4975	8710	19	33
L	1,248	416	7210	12620	17	30

[1/] Low estimates assume 50 percent of reductions in NF harvests will be offset by other ownerships; high estimates assume no offsets.

[2/] The number of non-direct jobs can be roughly approximated by multiplying the displayed estimates by 2.6.

The figures in the right-most columns of Table 2-8 are intended to suggest the magnitude of what must be given up to adopt varying levels of protection for spotted owls. These figures could be expressed also in terms of the economic effects in Table 2-7, because those effects are direct results of changes in harvest or employment. Obtaining any long-run benefits of an increased level of protection requires accepting immediate costs.

It was noted above that Alternative F is unique. The pattern of effects beyond the planning period is the same as for any harvest pattern that is a "departure" from the general policy of non-declining yield. Harvests during the planning period will lead to lower harvests and greater unemployment in later years if this alternative is extended beyond the current planning period. From this perspective, the tradeoff for Alternative F in Table 2-8 may be understated because it does not reflect possible reductions in employment in the more distant future.

Neither harvest reductions nor employment and economic effects would be distributed evenly across the Region. This is true because the dependency of particular communities on supply of logs from the National Forests for (domestic) processing varies widely. In addition, equal reductions in log flows would pose different levels of danger to the economic and social stability of particular communities. Where the processing of logs from the National Forests supporting spotted owls is most central to economic activity -- where communities most depend on this one industry and on these raw materials suppliers -- reductions in National Forest log flows would be most damaging. In general, western Washington and most of Oregon, except for the areas dominated by Seattle/Tacoma and Portland, would be most affected. The effects on subareas are discussed in more detail in Chapter 4.

The Relationship Between the Alternatives and the Issues and Concerns

The following discussion displays the relationship between the alternatives selected for detailed analysis and the Issues and Concerns.

Issue Number 1: The spotted owl management guidelines have been challenged as failing to consider the cumulative impacts of timber harvesting on the potted owl.

Response: In all 12 alternatives examined, the effects of timber harvesting on spotted owls was examined out to 500 years in the future. This was done by using Forest planning models for the 13 National Forests with spotted owl habitat, to predict changes in that habitat condition through time. (Refer to Appendix B for a more thorough discussion of the analysis.)

Issue Number 2: Current management guidelines in the Regional Guide contain information gaps and uncertainties regarding the probable impacts of timber harvesting on spotted owls.

Response: The interdisciplinary team has made a substantial effort to identify the information gaps and uncertainties with respect to timber harvesting and spotted owls. (Refer to Chapter 4) By doing a broad based literature review (Refer to Appendix C), some of the information gaps have been filled. The major uncertainties have been dealt with in the viability analysis for the owls. For example, it is uncertain whether the owls are presently crossing the Columbia River, so the viability analysis was run once with the assumption that owls cross the river and once with the assumption that the Washington and Oregon populations are isolated.

Issue Number 3: The Forest Service has not considered the worst case possibilities of proceeding with its current harvesting activities in the face of inadequate knowledge.

Response: The interdisciplinary team decided to deal with this issue by picking as wide a range of alternatives as possible. Alternative A, with no formal protection for owl habitat on National Forest lands coupled with the lowest survival rates observed, is discussed in the viability analysis section in Chapter 4. Also in the same Chapter is a discussion of uncertainty.

Issue Number 4: There are economic and social implications associated with alternative levels of spotted owl habitat protection.

Response: Each alternative was analyzed with regard to the economic and social implications. Figures showing levels of timber output, changes in employment, changes in returns to the United States Treasury and to the Counties were analyzed and displayed.

Issue Number 5: The Forest Service must minimize impacts to other resource management while providing protection of spotted owl habitat.

Response: The issue was addressed by selecting a wide range in alternatives and then varying the protection of owl habitat between alternatives on an incremental basis.

Issue Number 6: There is disagreement as to the habitat requirements of northern spotted owls.

Response: Although there is still disagreement about the habitat requirements for northern spotted owls, the literature review did allow the Interdisciplinary team to come up with a description of owl habitat attributes. (Refer to Chapter 3.) Since the ideal size of a habitat area could not be determined the alternatives were developed to test a wide range of sizes.

Chapter 3

AFFECTED ENVIRONMENT

OVERVIEW

This chapter describes the existing environment within the Pacific Northwest Region that will be affected by the implementation of the proposed alternatives for managing spotted owl habitat. The material presented in this chapter supplements the information contained in Chapter 3 of the Final Environmental Impact Statement for the Pacific Northwest Regional Guide.

PHYSICAL AND BIOLOGICAL SETTING

Physical Setting

The Pacific Northwest Region includes all the National Forest lands in the states of Oregon and Washington, as well as that within two counties in northern California and three counties in western Idaho. The area within the Region affected by spotted owl habitat management consists of forest lands extending from the Pacific Coast to the Cascade Mountain Range, including portions east of the Cascade Crest. North and south, the area reaches from the United States-Canadian border to northern California. This area corresponds closely to the distribution of the northern spotted owl, Strix occidentalis caurina, (Forsman and others, 1984). Refer to Figure 3-1.

Of the 19 National Forests within the Pacific Northwest Region, 13 are affected by the need to consider spotted owl habitat management. Of these National Forests, the affected area is over 13 million acres. Refer to Table 3-1. This table has been derived from data obtained from all the National Forests' "Analysis of the Management Situation" (AMS). The Okanogan National Forest, one of the 13 with spotted owl habitat, is cooperating with the Washington Department of Game to determine if the National Forest is within the range of the northern spotted owl. To date, only one pair of spotted owls has been detected within the Okanogan National Forest.

Biological Setting

This section contains information about the northern spotted owl and its needs. The information is needed to understand the issues and environmental consequences that are discussed in other chapters of this Supplement.

Figure 3-1. Spotted Owl Distribution.

Table 3-1

National Forests within the Pacific Northwest Region
Affected by Proposed Spotted Owl Management Alternatives

National Forest	Forested Acres 1/	Withdrawn Acres 2/	Technically Unsuit. 3/	Suit. for Harvest	Suit. for Owls 4/
Deschutes	1,367,300	113,100	105,500	1,148,700	22,100
Gifford Pinchot	1,161,206	202,156	19,456	939,585	448,500
Mt. Baker-Snoq.	1,308,400	286,500	417,100	604,800	276,550
Mt. Hood	832,241	127,340	57,783	647,118	256,000
Okanogan	1,487,330	529,360	254,766	703,200	15,000
Olympic	599,733	74,857	39,451	485,425	143,794
Rogue River	559,829	73,028	72,127	414,674	28,000
Siskiyou	1,035,508	232,016	178,050	625,442	297,000
Siuslaw	581,515	33,508	10,261	537,746	17,529
Umpqua	891,356	65,528	70,719	755,109	358,395
Wenatchee	1,451,098	436,829	222,370	791,899	89,315
Willamette	1,507,227	327,565	348,532	1,005,396	485,619
Winema	980,350	87,690	57,070	834,800	46,700
TOTAL	13,763,093	2,589,477	1,853,185	9,493,894	2,484,502

1/ Includes lands suitable for timber production and lands not suitable or available for timber production.

2/ Includes lands withdrawn by Chief's authority or higher.

3/ Includes lands not suitable for timber production because of irreversible resource damage to soils or watershed values or regeneration uncertainty.

4/ Suitable owl habitat includes lands tentatively suitable for timber harvest and those technically unsuitable for timber harvest.

What is a spotted owl?

The spotted owl is a medium-sized, nocturnal bird that inhabits the mountainous, forested regions of the West. The American Ornithologist's Union recognizes three distinct subspecies of the spotted owl. The three subspecies are: (1) The northern spotted owl, Strix occidentalis caurina; (2) The California spotted owl, Strix occidentalis occidentalis and; (3) The Mexican spotted owl, Strix occidentalis lucida (American Ornithologists Union, 1983).

The northern spotted owl has dark-brown plumage with irregular, white spots on the back and barred rows of irregular, tawny-white blotches on the chest. It is a round-faced, brown-eyed bird lacking the eartufts commonly found in other owls (Forsman and others, 1984). Refer to Appendix C which contains information on northern spotted owls.

What is the habitat of the northern spotted owl?

The northern spotted owl lives in the dense, older forests of the Pacific Northwest. Spotted owls have been reported in almost all of the major types of coniferous forest in the Pacific Northwest. Within the range of the species, spotted owls tend to occur at increasingly higher elevations, going from north to south (Forsman and others, 1984; Gould, 1974). Spotted owls occur at higher elevations in Oregon than in Washington, as the gradual changes in vegetation and climate reflect changes in latitude (Refer to Appendix C). Forest types occupied by the northern spotted owl are identified in Figure 3-2.

Spruce--cedar--hemlock forest

Cedar--hemlock--Douglas-fir forest

Mixed conifer forest

California mixed evergreen forest

Silver fir--Douglas-fir forest

Red fir forest

Ponderosa shrub forest

Fir--hemlock forest

Western ponderosa pine forest

Figure 3-2. Forest Types that are Used by Spotted Owls in the Pacific Northwest. From 1964 Kuchler vegetation types. Source: Regional direction; 1920 memo of 2/19/83 and 1920 memo of 4/16/84.

The occurrence of owls in the fir-mountain hemlock and ponderosa stands is usually limited to that range of elevation where a dominant component of the forest, in both the overstory and understory, is white fir or silver fir, or both.

Carey (1985) lists forest types not used by spotted owls. These types include subalpine fir and pure stands of ponderosa pine, lodgepole pine, and Sitka spruce.

What is the association of the spotted owl with old-growth forests?

Many researchers consider the northern spotted owl to be closely associated with old-growth and mature Douglas-fir forests (Forsman and others, 1977, 1984, 1985; Gould, 1974, 1985; Solis, 1983; Sisco and Gutierrez, 1984; Gutierrez and others, 1984; Marcot and Gardetto, 1980). The association of the northern spotted owl with mature and old-growth conifer forests has been studied in Oregon, Washington, and northern California.

Forsman and others (1984) evaluated the characteristics of 595 occupied spotted owl habitats in Oregon (stand size was not reported). They reported that 98 percent of the occupied spotted owl habitats were in forest stands that were 100 to 200 years of age or older. Forsman combined data on habitats from these 595 sites with additional sites that had been located in Oregon since 1980. Of the nearly 1500 total sites in Oregon where spotted owls occurred, 93 percent were in forests over 100 years old. Refer to Appendix C.

Postovit (1977) surveyed 150 randomly selected sites in Washington. Of 20 sites occupied by spotted owls, 90 percent were in forests more than 120 years old. In northern California, Marcot and Gardetto (1980) reported 95 percent of occupied spotted owl habitats were coincident with mature and old-growth forests. Gould (1974) described the characteristics of 192 occupied sites in mature forests of northern California. Eighty-three percent of the sites were in sawtimber greater than 21 inches in diameter and 180 years or more in age.

What is the association of the spotted owl with other habitats?

The occurrence of spotted owls in habitats other than mature and old-growth forests has been reported. Forsman and others (1984) found seven of 595 occupied spotted owl habitats in forest stands that were less than 100 years old (stand size was not reported). In these stands, small patches of old growth were present. Three other spotted owl pairs occupied forests that were less than 100 years old in which little or no old growth was present. Only two pairs had nested on these ten occupied sites. One pair nested unsuccessfully for three years. During this time, the other pair had young for two consecutive years. It is not known if the young survived.

In Washington, Postovit (1977) found spotted owls occupying two sites in stands less than 120 years old. These two occupied areas were out of a total of 20 sites. Becksted (1985) reported two locations on the Olympic National Forest where spotted owls were using dense, stagnated stands less

than 100 years old. One of the pairs produced two fledglings. They nested in a stand of trees that were up to 90 years old. The stand was interspersed with larger trees and snags (standing dead trees).

Researchers have recognized that there are variations in the habitat used by spotted owls (Barrows, 1985; Gutierrez, 1985). Barrows suggests that populations of spotted owls in the poor environments may not persist without movements into these habitats by owls from areas where breeding has been highly successful. Gutierrez and others (1984) comment that owls found in habitats other than old growth may reflect genetic or individual variation.

Do northern spotted owls prefer old-growth forests?

The preference of northern spotted owls for old-growth forests has been studied by several researchers. In northern California, Marcot and Gardetto (1980) found spotted owls to be three times more abundant in old-growth forests than in mature forests. In the Cascade and Coast Ranges of Oregon, Forsman and others (1977) found that spotted owls were 12 times more abundant in old growth than in forests less than 80 years old. In the Olympic and Cascade mountains of Washington, Postovit (1977) found spotted owls to be five times more abundant in stands greater than 120 years old than in younger, second-growth forests.

The hypotheses for the association of spotted owls with old-growth forests in the Pacific Northwest have been summarized from the literature by Carey (1985). Carey demonstrates that old-growth forest has the structural characteristics and types of vegetation that best provide the spotted owl with food, cover, nest sites, and protection from predation. The adaptation hypothesis, an untested idea, states that spotted owls have adapted to old growth because these forests have been the major feature of the landscape for generations of owls (Carey, 1985).

What are the characteristics of suitable habitat for the northern spotted owl?

Aside from labels of "mature," "old growth," and "second growth," the general characteristics of suitable spotted owl habitat can be described (Carey, 1985). Suitable spotted owl habitat is composed of:

-- multi-layered stands of trees with an overstory, midstory, and understory;

-- large trees with cavities, broken tops, and platforms of big branches holding accumulated organic matter suitable for nesting; and

-- dead standing trees and fallen decayed trees to support abundant populations of species that are prey for the spotted owl. Such species include the woodrat and flying squirrel.

The characteristics of spotted owl habitat, as described in the literature, are presented in Table 3-2.

How much suitable habitat is needed for spotted owl pairs?

Annual home ranges of six radio-tagged spotted owl pairs in Oregon varied from 2840 to 10,146 acres, with a mean of 6614 acres (Forsman and others, 1985). Within these home ranges, the amount of old growth varied from 1008 acres to 3786 acres, with a mean of 2264 acres. Two of the values are considered questionable by Forsman due to uncertainty about whether the four birds were actually two pairs. One of these questionable values is the highest one, 3786 acres. In California, the size of annual home ranges and the amount of suitable habitat used by breeding pairs of spotted owls has not been determined. Allen and Brewer (1985) studied three pairs of spotted owls in north central Washington and found an average of 4202 acres of old growth and an average annual home range of 8585 acres per pair. Spotted owls in Washington appear to use more old growth than do those owls in Oregon.

The data suggest that home range size is inversely related to the quantity of old growth available to a spotted owl pair. As the amount of old growth declines in an area, the home range size increases. Forsman and others (1984) reported that spotted owl home ranges tended to be larger when old growth stands were in small, isolated patches or fragments.

What areas of uncertainty exist in our knowledge of the northern spotted owl?

Differences in definitions of "old growth" cause confusion over what is considered to be suitable spotted owl habitat. For example, Postovit (1977) defined old growth as forest stands older than 120 years. However, the Pacific Northwest Regional Guide defines old growth according to forest type and stand characteristics, rather than age. (Refer to Chapter 3, page 40 of the Regional Guide.) For this reason, age and forest characteristics are included, when available, for every citation of "old growth" used by spotted owls. Differences in definitions of "old growth" by researchers and management agencies confound efforts of all interested parties in establishing the quantity and type of habitat needed for the spotted owl. The amount of suitable habitat (old growth, mature forest, or a set of stand structural characteristics) needed by a pair of spotted owls is also uncertain.

There is uncertainty about the knowledge of the demographics of the spotted owl. Demography is the statistical study of population characteristics, with reference to size, density, distribution, and vital statistics. Information lacking in spotted owl demographics includes:

-- life expectancy
-- reproductive age
-- age structure of the population(s)
-- rate of successful reproduction
-- rate of survival of offspring
-- frequency of colonization of vacant habitats
-- effects of forest fragmentation (Carey, 1985)

Table 3-2

Habitat Characteristics of Spotted Owls

Attribute	State	Sample Size	Range of Data (Mean)	Reference
Tree Canopy Structure				
1. Multilayered, uneven-aged. Overstory of large mature to overmature trees. Understory trees pole to immature.				
a. Nesting habitat	OR	47 sites	90% >200 yr 4% 100-140 yr 6% 70-80yr	Forsman and others 1984
b. Foraging habitat	OR	8 adult	63-98% of time in >80 yr	Forsman 1976
c. Roosting habitat	OR	1098 sites	91-97% of time in ≥ 200 yr 2.4-5% of time in 30-200 yr	Forsman 1980,1984
Tree Canopy Closure				
1. Composite across tree layers. Given in percent.				
	OR	42 sites	Range: 65-80%	Forsman and others 1984
	WA	18 sites	45-70%	Postovit 1977
	WA	13 sites	(90.8%)	Garcia 1979
2. Nesting habitat				
	OR	18 sites	Range: 53-86%	Forsman 1976
	CA	122 sites	40-90%	Gould 1977
	OR	26 sites	35-91% (69%)	Forsman 1984
3. Foraging habitat				
	CA	205 sites	42-100% (87.8%)	Ruediger 1984 Solis 1982
a. Winter season	CA	25 sites	(88.3%)	Sisco 1984
	CA	199 plots	(67.9%)	Laymon and Barrett 1985
b. Summer season	CA		(29.7%)	Laymon and Barrett 1985
4. Roosting habitat				
	CA	12 sites	64-98% (86.7%)	Solis 1982

Table 3-2 (Continued)

Habitat Characteristics of Spotted Owls

Attribute	Area	Sample Size	Range of Data (Mean)		Reference
Elevation					
1. Upper limit	WA		No. Cascades	(Feet) 4,400	Forsman and others 1984
	WA		Giff. Pinchot NF	4,100	Garcia 1979
	OR		Central Cascades	5,000	Forsman and others 1984
	OR		South Cascades	6,000	Forsman and others 1984
	OR		Klamath Mts.	6,000	Forsman and others 1984
	OR		Coast Range	3,700	Forsman and others 1984
	WA		Olympic Pensisula	3,200	Postovit 1977
	CA		Six Rivers NF	4,600	Solis 1982
Distance to Water					
1. Nesting habitat	OR	18 sites	49-4650 feet [83% within 1312 ft.]		Forsman 1976
	CA		<984 feet		Gould 1977
2. Foraging habitat	CA	25 sites	(492 ft)		Solis 1984
	WA	13 sites	0-3168 ft (722 ft)		Garcia 1979
3. Roosting habitat	CA	10 sites	(538 ft)		Barrows and Barrows 1978
	CA	10 sites	82-738 ft (541 ft)		Barrows 1981
	CA	12 sites	0-2100 ft (469 ft)		Solis 1982
	WA	18 sites	0-2953 ft [70% within 1150 ft]		Postovit 1977
Standing and Downed Dead Trees					
1. Snags per acre	WA	205 sites	4-48/acre		Ruediger 1984
2. Downed logs per acre	WA	205 sites	8-82/acre		Ruediger 1984
	CA	61 sites	57.2-73.2 tons/acre		Laymon and Barrett 1985

A review and synthesis of values for several demographic parameters obtained from field studies and the literature is described in Appendix B. The significant results of this review are presented in Table 3-3. Estimates from existing field studies of juvenile survival and birth rates are so low one would expect spotted owl populations to be rapidly declining. Such a rapid decline in spotted owl populations has not, however, been observed in the last ten years (Forsman and others, 1984; Gould, 1985). The long term rates of birth and juvenile survival are uncertain.

Another area of uncertainty is the possible isolation of spotted owl populations. Juelson (1985) suggests that spotted owl populations in different parts of the Pacific Northwest may be isolated from one another. This may be particularly true of those populations inhabiting the Coast Range in Oregon and the Olympic Peninsula in Washington. He also suggests that spotted owls in Washington may be isolated from the spotted owls in Oregon by the Columbia River (see Figure 3-3). No definitive information exists to establish if there is isolation within northern spotted owl populations or between northern and California spotted owls.

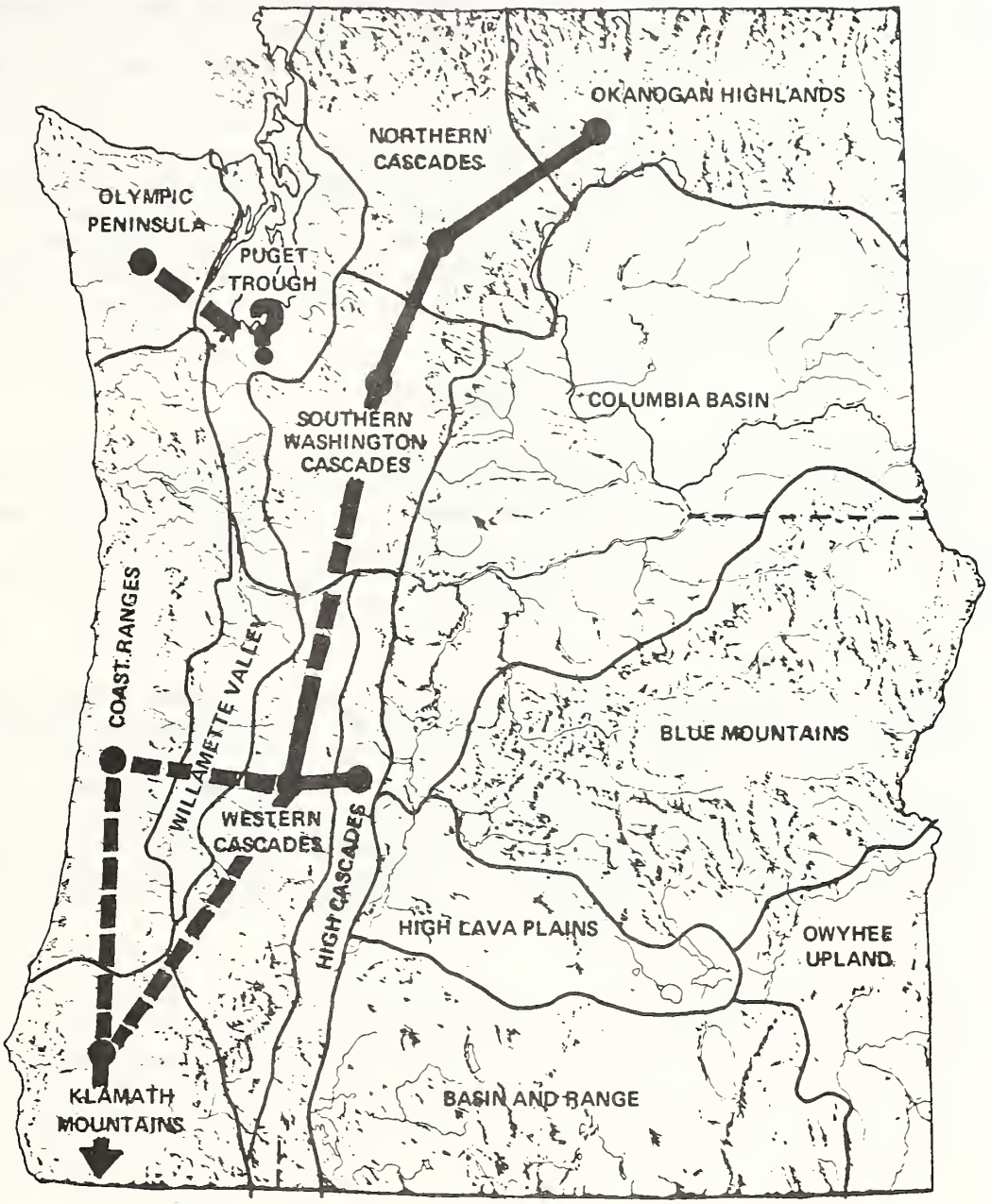
Table 3-3

Demographic Information Derived from Field or Literature Estimates

Demographic Information	Field or Literature Estimates
Juvenile survival	12%
Adult survival	85%
First year of reproduction	Year 3
Birth rate (juvenile owls per pair)	0.55

Studies of the abilities of juvenile spotted owls to disperse have shed some light on the extent of isolation among populations of spotted owls (Forsman, 1980; Gutierrez and others, 1985; Meslow, 1984). The dispersal studies were summarized by Marcot in the viability analysis used in this Supplement. The documents describing the process are in the Land Management Planning files in the Pacific Northwest Regional Office.

Looking at the three studies (Forsman, 1980; Gutierrez and others, 1985; Meslow, 1984), Marcot evaluated the maximum distances traveled by the juvenile spotted owls. Nearly 80 percent of the juvenile owls that were studied traveled no more than 12 miles. In 29 cases, 14 percent of the owls traveled 40 miles or more. Nevertheless, it appears that juvenile



Physiographic and geological provinces of Oregon and Washington
(from Franklin and Dyrness, 1973)

Figure 3-3. Distribution of Northern Spotted Owls by Physiographic Province. Solid Lines Denote Lack of Barriers to Genetic Interchange, Dashed Lines Denote Where the Degree of Genetic Interchange is Unknown.

spotted owls do occasionally travel great distances. Sixty-two miles was the maximum distance traveled by those owls that were studied. It should be noted that the spotted owls of the Olympic Peninsula are separated from the nearest neighboring population of spotted owls by more than 62 miles.

Whether the Columbia River is a barrier to the travel of spotted owls is still uncertain. The distance between populations of spotted owls in Oregon and those in Washington is less than 40 miles; but the owls appear reluctant to disperse across wide expanses of water. The Washington Department of Game is conducting a study that may provide information on this question. The study is of spotted owls that have occupied an island in Willapa Bay. The results of this study will help clarify the ability of the spotted owl to disperse across water.

What is the status of the northern spotted owl?

Stein (1982) estimated the total population of the northern subspecies of the spotted owl to be approximately 2500 pairs. He disclaimed use of this population figure because it was an estimation. Forsman and others (1984) suggested a total population of 1000 to 1200 pairs in Oregon. This estimate is based upon surveys conducted between 1969 and 1979. The number of spotted owl pairs within the range of the northern subspecies is unknown.

Forsman reported in January, 1986, that spotted owls occupied 1500 sites in Oregon (Refer to Appendix C). Gould reported that, as of October, 1985, northern spotted owls have been located at 772 sites in California (Refer to Appendix C). There are roughly 300 sites where spotted owls have beenreported in Washington (Refer to Appendix C). The northern spotted owl is considered rare in British Columbia (Campbell and Campbell, 1984). Surveys by the Ministry of Environment in British Columbia have determined that only four sites were occupied by northern spotted owls in 1984 (Refer to Appendix C).

The California Department of Fish and Game has classified the spotted owl as a "species of special concern," although this designation carries no legal status (Gould, 1985; Stein, 1982). The Oregon Department of Fish and Wildlife has designated the spotted owl as a threatened species, but the classification gives no legal status (Carlson and Haight, 1985; Stein, 1982). The Washington Department of Game has classified the spotted owl as a threatened species. The owl receives full protection under Department of Game authority.

The Pacific Northwest and Pacific Southwest Regions of the Forest Service have identified the northern spotted owl as a sensitive species. Sensitive species are plants or animals recognized by the Regional Forester as needing special management to prevent their classification by Federal and State agencies as "threatened" or "endangered."

During the process of developing the land management plans for the National Forests in the Pacific Northwest and Pacific Southwest Regions, the spotted owl was selected as a management indicator species for old-growth habitat. A management indicator species can be used by forest managers and wildlife

biologists to predict whether an area is suitable for a variety of species having similar habitat requirements (USDA Forest Service, 1985).

The Forest Service has planned to provide habitat for 551 pairs of spotted owls in the Pacific Northwest Region and 500 pairs of both subspecies in California.

Populations of spotted owls on lands managed by the U.S. Department of Interior, Bureau of Land Management, are estimated at about 118 pairs (Carlson and Haight, 1985). There are 177 sites on which owls have been located; but these include both single owls and pairs. That agency's timber management plans protect 79 pairs for the next ten years. An interim agreement between the Bureau of Land Management and the Oregon Department of Fish and Wildlife protects 90 pairs for the next two years. The plans provide 300 acres of habitat per pair.

In total, current management plans for all Federal agencies will provide for 800 to 1000 pairs of northern spotted owls in the Pacific Northwest (Carey, 1985). Refer to Table 3-4 for a list of current goals, by agency, for spotted owl management. The goals as listed on this table do not reflect full capacity on reserved lands.

What is the existing inventory of suitable spotted owl habitat?

Estimates of suitable spotted owl habitat in the Pacific Northwest, by ownership, are presented in Table 3-5. There are nearly 4.7 million acres of habitat suitable for spotted owls. Nearly 1.5 million acres of suitable spotted owl habitat are reserved in Federal wilderness and park lands. The National Park Service estimates that there are 530,000 acres of spotted owl habitat within the national parks and monuments. Based on timber inventories conducted during the late 1970's on Bureau of Land Management lands, it is projected that 395,000 acres of old-growth forest now remain.

Within the Pacific Northwest Region of the Forest Service, approximately 3,633,500 acres currently provide suitable habitat for the northern spotted owl. Nearly 68 percent of the acres of habitat coincide with lands that are also suitable for the production of timber. The remaining 1,152,600 acres of suitable spotted owl habitat are in areas not suited for the production of timber or reserved for other purposes, such as wilderness. Table 3-11 lists the current inventory of suitable spotted owl habitat by National Forest.

What do we know about the trends in northern spotted owl population and habitat?

Many researchers report that the number of northern spotted owls and the amount of their habitat is decreasing (Forsman, 1976; Forsman and others, 1977, 1982; Garcia, 1979; Gould, 1974, 1977, 1979). Gould (1985), however, believes that exact estimates of trends are difficult to determine in some areas because of the lack of information on the distribution of the owls and the density of the population prior to 1973. Gould (1985) illustrated this with the 1971 estimate of only 30 pairs in California.

Population trends in California have been estimated by Gould in 1985 from information on density and home range. He calculated a reduction of at least 50 percent from estimates of historial densities.

Gould (1985) reports a reduction of 4.5 percent from 1974 to 1983. In Oregon, Forsman monitored 98 sites occupied by spotted owls and noticed a 1.1 percent annual rate of decline from 1972 to 1978 (Refer to Appendix C). Although a monitoring program has recently been established, there are no published data on populations trends in Washington (Becksted, 1985; Carey and Ruggiero, 1985).

Carey (1985) reported that, in the Pacific Northwest, there are only five million acres of the estimated 15 million acres of the old-growth forests that existed in the 1800's. In 1984, the Regional Forester estimated that the National Forests west of the Cascade crest had 2.5 million acres of forests more than 250 years old.

Not all mature and old-growth forests are suitable for spotted owl habitat. For example, high elevation forests of subalpine fir are not typically used by spotted owls (Forsman and others, 1977, 1984; Carey, 1985). Conversely, spotted owls are reported in forests of 100 years and older (Postovit, 1977; Forsman and others, 1984) which are often called "mature" forests. The suitable habitat contained in mature and old-growth forests of the Pacific Northwest Region is being harvested at the estimated rate of 40,000 acres per year. Harvest in old-growth forests, whether suitable for owls or not, is approximately 36,000 acres per year.

The trends showing the reduction of spotted owl habitat on state, local government, private, and tribal lands are presented in Table 3-6. The information on habitat and trends for non-Federal lands was derived from timber inventory data obtained from the Pacific Northwest Forest Experiment Station. Refer to "Compilation of Northern Spotted Owl Habitat," available in the Regional Office land management planning records.

Suitable spotted owl habitat on non-Federal lands in Oregon decreased by 77 percent between 1961-62 and 1984-85. Data for 1984-85 for the state of Washington were unavailable. Based on the trends observed in Oregon, a projection was made on habitat reduction for the years of 1975-76 to 1984-85. Based on this projection, it is estimated that suitable spotted owl habitat on non-Federal land decreased in Washington by approximately 81 percent between 1961-62 and 1984-85.

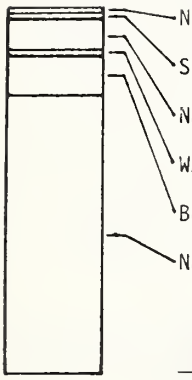
SOCIAL AND ECONOMIC CHARACTERISTICS

This section supplements the "Social and Economic Characteristics" section in the Regional Guide, updating the information to reflect changes which have occurred since it was written.

Those National Forests that provide spotted owl habitat are located primarily on the west side of the Cascades (see Figure 3-1). While the socioeconomic effects of alternative management for spotted owl habitat will be most strongly felt in the communities closely associated with these

Table 3-4

Current Goals for Management of Spotted Owl Habitats



AGENCY/ORGANIZATION	NUMBER OF HABITAT AREAS			
	OREGON	WASHINGTON	N. CALIFORNIA	TOTAL
Nature Conservancy	0	0	2	2
State Parks	0	0	12	12
National Park Service	7	54	11	72
WA DNR/OR DF/CA DF	0	3	1	4
Bureau of Land Management	79*	0	11	90
National Forests	269*	121*	247*	664
			Total	884

* Indicates that figures are current agency goals, remainder of figures indicate capability or known territories

Table 3-5

Currently Suitable Spotted Owl Habitat in the Pacific Northwest by Land Ownership

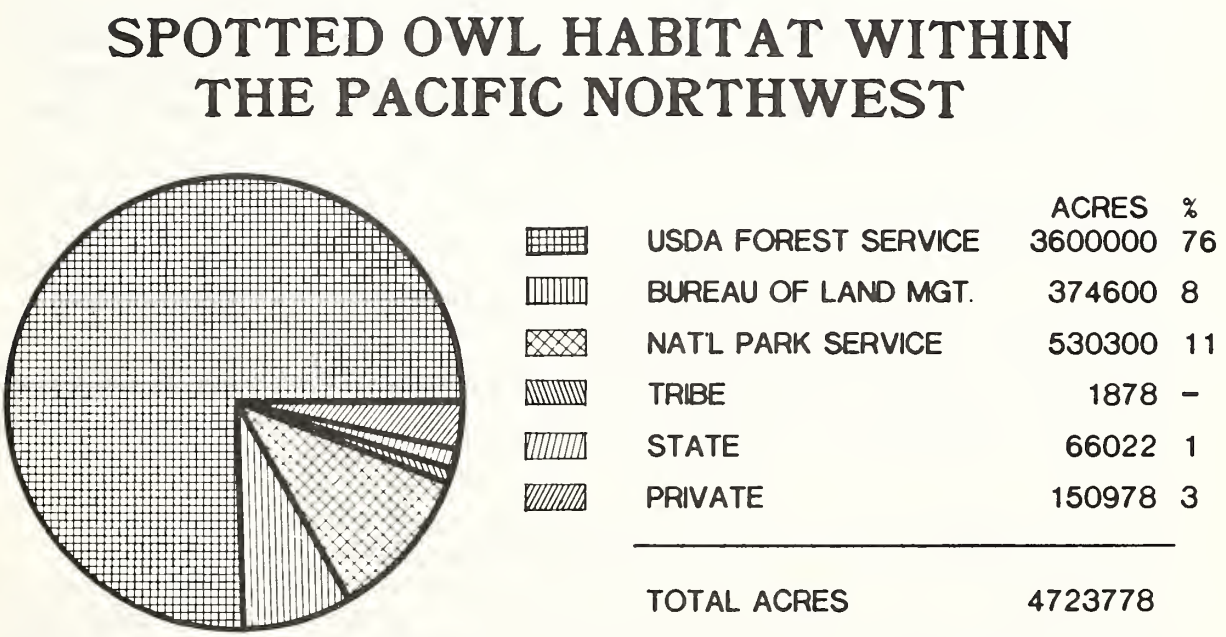
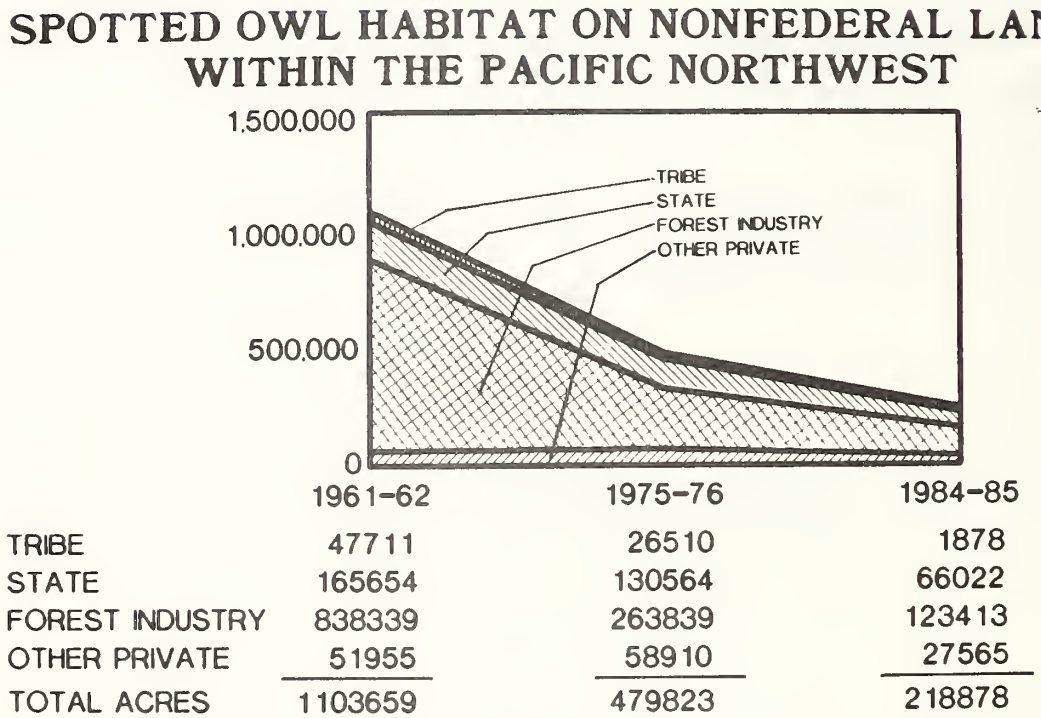


Table 3-6

Trends in Spotted Owl Habitat on Non-Federal Lands
Within the Pacific Northwest



forests, the interrelated nature of the timber industry and the size of the area affected make it more practical to discuss the states of Washington and Oregon as a whole. The discussion will emphasize those areas closely tied to the forests with spotted owl habitat.

Social Setting

Several communities in western Oregon and Washington, the towns of Sweet Home, Oakridge, and Morton being examples, depend on the wood products industry as a major source of employment and income. As such, factors affecting the future of these communities and others like them include changes in timber supply, technological changes within the industry, and changes in the demand for lumber.

One major component of the timber supply issue is the availability of old-growth timber. The supply of old-growth timber is rapidly being depleted on private industry's lands. Availability is also diminishing on public lands, due in large part to concerns over environmental issues such as the protection of watersheds and wildlife habitat. Mills in the Pacific Northwest have historically depended on old-growth timber; therefore, many

are generally equipped to process the large logs obtained from such stands. In order to accommodate the smaller second-growth logs, the lumber mills would need to be retooled.

Discussions in several of the National Forests' AMS's, indicate that some rural communities in western Oregon and Washington, which depend greatly on timber supplied from National Forest lands, are being affected by decisions concerning timber supply, as well as by market demand and factors concerning mechanization for different sized products. Issues related to the provision of habitat for northern spotted owls will directly influence the supply of timber if old growth is withdrawn from regularly scheduled harvest. Withdrawal of old growth would have the potential to accelerate the conversion of mills to processing the smaller logs that are typical of second-growth. International demand for West Coast lumber may also decline as lumber from old growth, with its typically higher quality, is replaced by second-growth material.

Seventy-four percent of the population of Oregon and Washington live in the 18 counties that make up these states' urban metropolitan areas. The west side of the Cascades is by far the most heavily populated area of the region. Seventy percent of the total population is concentrated in the narrow strip of counties in both states adjacent to the interstate highway that runs north and south, I-5. Most of the remaining 30 percent live along the coast and east of the Cascades.

The population of the Pacific Northwest Region has not increased as rapidly over the past five years as had been projected in the 1980 census. Some counties, such as Coos, Douglas, and Lane counties in Oregon and Gray's Harbor in Washington, had a decrease in population during this period. This was largely because of the 1981-83 recession, during which there was a net migration out of the two-state region. Adjusted estimates project a 12 percent increase between 1980 and 1990, with an additional 16 percent increase by the year 2000.

In 1980, racial and cultural minorities constituted a small part of the total population of Oregon and Washington. Blacks were 2 percent of the total population, Hispanics, 2 percent, and American Indians, 1 percent. Blacks in the Pacific Northwest Region live predominantly in urban areas. A disproportionate number of American Indians and Hispanics live in rural areas when compared to the states' overall population.

These population trends, along with the social values and lifestyles more typical of urban residents, have significant implications for management of the National Forests. The changes in population mean changes in the public's preferences for forest uses. The effects of these trends in the Pacific Northwest Region include the following:

a. Growing residential use of land adjacent to many National Forests increases pressure to manage nearby forest land to emphasize amenities instead of commodities.

b. The public is increasingly concerned with environmental issues, such as air and water quality and the presence of chemicals and

noise. These concerns often pertain to local situations on a day-to-day basis, especially for those who live near the forest. When residential developments are adjacent to land managed for forest uses, timber harvest and fire provoke public concern.

c. In general, there is an increased demand by the public for amenities from forest land, such as dispersed, unstructured recreation and scenic quality. This is true even when the amenities appear to be in conflict with economic growth.

d. There is an increased use of National Forest resources for personal use. These resources include firewood, fish and game animals, and food from plants, such as huckleberries.

Economic Setting

The Pacific Northwest has historically been a major exporter of timber, agricultural products, and fish. Wood products are especially important to all levels of the regional economy, with approximately 44 percent of Oregon's economy and 28 percent of Washington's economy directly dependent on National Forest resources. Thus, changes in the national demand for wood products significantly affect employment in Oregon and Washington.

The recession in the early 1980's clearly demonstrated the link between demand for wood products and employment in the Pacific Northwest. The high interest rates and corresponding decline in the housing market severely affected the economy of the Pacific Northwest because of the dependence on the wood products industry.

Unemployment rose sharply during this period. Although it has subsided somewhat, it remains higher than the pre-recession levels. Unemployment remains higher than the national rate, particularly in areas most heavily dependent on the lumber and wood products industry.

The timber industry is experiencing major changes both regionally and nationally. These are changes in the technology used to process raw materials, organizational changes in the major wood products firms operating in the Pacific Northwest, and changes in the demand for wood products resulting from economic shifts in interest rates and oil prices.

The last recession resulted in reduced regional market shares for some wood products produced in the Pacific Northwest. The wood products processing firms responded to these changes by improving the operating efficiency of their plants to make them more competitive. As a result, productivity of the workers increased significantly. Recent changes in the economy, particularly interest rates and oil prices, have stimulated the economy and increased the demand for wood products. As a net result, wood products production has returned to near pre-recession levels, but employment has not due to the increased productivity per worker.

While timber and agricultural products are expected to continue to play a significant role in the Pacific Northwest regional economy, there is a

drive toward economic diversification. The primary centers of growth and diversification are in the metropolitan areas of the Puget Sound and the Willamette Valley, located west of the Cascades, and Spokane, located east of the Cascades. This diversification includes trade, finance, tourism, government, and the manufacture of other durable goods, such as electronics.

As mentioned previously, much of the diversification within the Pacific Northwest Region is occurring in the more heavily populated metropolitan areas. In other areas, communities continue to be highly dependent on wood products. Occupations involved with wood products include logging and working in sawmills and the related transportation and construction industries.

RESOURCE ELEMENTS

Recreation

The National Forests of the Pacific Northwest Region provide a significant number of opportunities for the public to enjoy the outdoors. Whether the desire of the recreational user is sight-seeing along a major highway or finding solitude in a remote wilderness, these lands provide the setting for a broad range of recreational activities. The primary purpose of recreation management within the Forest Service is to make available these opportunities for outdoor recreation.

For planning purposes, the range of recreational opportunities can be expressed as six Recreation Opportunity Spectrum (ROS) classes: primitive, semi-primitve non-motorized, semi-primitive motorized, roaded natural, rural, and urban. (See Glossary for the definitions of the ROS classes.) Each ROS class describes a physical, social, and managerial setting within which a variety of experiences can be had. Northern spotted owl habitat can be found within or adjacent to land placed in any of the ROS categories.

Of all the recreational uses within the Recreation Opportunity Spectrum, those that occur in areas designated as primitive and semi-primitive may have the least conflict with management of spotted owl habitat. Some uses within the other ROS categories may also be compatible with the continued presence of spotted owls.

Most spotted owl responses during census occurred in areas that were in the primitive, semi-primitive, and roaded categories. It may be that the presence of roads does not detract from the suitability of owl habitat provided that other factors, such as size of home range, structural characteristics of the timber stands, and harvest unit dispersion, are satisfactory.

Certain recreational uses, such as camping in developed campgrounds and use of off-road vehicles, could affect northern spotted owl habitat. It is not known, however, if this type of recreation interferes with the success of the owl's nesting or juvenile survival and dispersion. Spotted owls are

primarily nocturnal foragers. This may suggest that these recreational activities could be compatible with the owls, even within their home ranges.

Riparian areas, which are the lands adjacent to streams, rivers, and lakes, are frequently used by recreational visitors. Water based recreation, such as camping, hiking, hunting, and fishing, is a popular and important use of National Forest land. Developed recreational sites are often located in valley bottoms near or within floodplains. Many prominent riparian areas are being considered for inclusion in the National Wild and Scenic Rivers system, which may increase recreational use. Riparian areas are also used by spotted owls (Barrows, 1981). Owls use them as travel corridors between habitat areas. Nest sites are often located in or near riparian areas.

The demand for all types of outdoor recreation will increase. Beyond the year 2000, it is assumed that, as the character of some areas is changed by timber management and use of other resources, recreational use of the remaining undeveloped areas will increase. Spotted owls and humans may be sharing the same part of the forest more frequently in the future. It is not known if this will be a problem. Whether the presence of humans or the physical alteration of the habitat is more important to the viability of the spotted owl is unknown.

Roadless Areas

Throughout the Pacific Northwest Region, there are areas on the National Forests that are basically undeveloped, with no roads built into them. During the second Roadless Area Review and Evaluation (RARE II) process these areas were studied for their suitability for inclusion into the Wilderness System. The areas so studied were officially designated as roadless areas.

By passing the Washington Wilderness Act and Oregon Wilderness Act in 1984, Congress created wildernesses out of a number of roadless areas. Many designated roadless areas were left, however. The management of the remaining roadless areas is regulated by existing land management plans.

The possibilities for managing each roadless area range from fully developing its resources to maintaining its roadless character. Some portions of the roadless area could be managed for spotted owl habitat. Refer to Table 3-7 for the acres of suitable habitat available in the roadless areas of the 13 National Forests with spotted owls.

Reserved Lands

Reserved areas are those lands which have been set aside for a specific use or purpose by Executive Order or legislation. Examples of reserved areas are wilderness; research natural areas; experimental forests; geologic, historic, and botanical areas; and specific municipal watersheds. For some kinds of designations (wilderness, natural areas, some watersheds) little or no development is permitted, and natural processes are stressed in their

management. This may include permitting natural fires to burn, providing there is no danger to adjacent lands.

The amount of reserved land varies considerably among the National Forests of the Pacific Northwest Region. Table 3-8 lists the acres of forested, reserved land designated for each of the 13 National Forests with spotted owls. On the forested acres within these 13 National Forests, the wilderness designation, for instance, ranges from 5.8 percent (Siuslaw National Forest) to 21.9 percent (Mt. Baker-Snoqualmie National Forest) of each forest's net acreage having a forest cover.

Although much of this land is alpine or subalpine in character, all or portions of several reserved areas are at lower elevations. Many of these lower elevation areas have environments that are currently mature and old-growth forest suitable to support northern spotted owls (see Table 3-8).

Because the policy of wilderness management is to allow natural processes to change the ecosystems, the number of suitable spotted owl habitat areas will vary over time. The fluctuations in number of habitats may be dramatic within any one wilderness. For example, a large fire may, within a few days, remove a suitable spotted owl habitat area in one wilderness. On the other hand, if there is no fire for for several decades, suitablehabitat may increase in another wilderness.

There is, therefore, uncertainty about the effects of fire on spotted owl habitat in wilderness. The effect of fire on the spotted owl's prey and the structure of the forest understory is not known, as its significance has not been investigated.

Visual Resources

Scenic vistas are included in the resources provided by the Region's National Forests. These beautiful landscapes, so appreciated by visitors to the National Forests, are called visual resources. Landscapes managed for visual resources include areas that are left in their natural state and areas that are altered by human activities. Since the early 1900's, the visual resources in the Pacific Northwest Region have been significantly influenced by the prevention of catastrophic wildfires. Since the middle 1950's, the main agents of change have been road construction and timber harvesting.

In order to manage the visual resources, management objectives were developed that describe the amount of human alteration of the landscape that is allowed. Within each category of these objectives, a different degree of alteration is permitted. (Refer to the Glossary for a definition of the visual quality management objectives.)

Those areas, such as wilderness and research natural areas, that are managed to allow natural changes are classified under the Preservation Visual Quality Objective. Because the Preservation Visual Quality Objective allows only ecological change, the amount of spotted owl habitat

will depend on the kind and rate of these changes in the management areas that are so classified. Landscapes classified under the Retention and Partial Retention Visual Quality Objectives are to be natural appearing. Management is allowed, but changes are to blend into the natural landscape. For instance, timber harvest units are laid out so that they appear unobtrusive to the casual observer. Timber harvest rotations are longer than usual so that, over time, stands of large trees are maintained and the visual impact of timber harvest is decreased.

Table 3-7

Acres of Suitable Spotted Owl Habitat Within Roadless Areas of the National Forests in the Pacific Northwest Region

National Forest	Total Acres in Roadless Areas	Roadless Area Acres that are Suitable Spotted Owl Habitat
Deschutes	145,142	1,238
Gifford Pinchot	205,530	35,000
Mt. Baker-Snoqualmie	407,389	189,686
Mt. Hood	116,000	47,560
Okanogan	481,368	17,000
Olympic	50,000	16,500
Rogue River	85,075	9,522
Siskiyou	314,025	99,695
Siuslaw	26,638	26,638
Umpqua	160,833	122,725
Wenatchee	556,272	99,492
Willamette	209,712	126,958
Winema	32,218	4,168
Total	2,790,202	796,182

Table 3-8

Reserved Acres Within 13 National Forests of the Pacific Northwest Region and Amount Considered Suitable Spotted Owl Habitat[1/]

National Forest	Forested Acres	Forested Lands in Reserved Status	Suitable Owl Habitat on Reserved Lands
Deschutes	1,367,300	113,100	4,100
Gifford Pinchot	1,161,206	202,156	41,400
Mt. Baker-Snoq.	1,308,400	286,500	165,150
Mt. Hood	832,241	127,340	45,000
Okanogan	1,487,330	529,360	115,000
Olympic	599,733	74,857	25,975
Rogue River	559,829	73,028	9,000
Siskiyou	1,035,508	232,016	73,000
Siuslaw	581,515	33,508	3,235
Umpqua	891,356	65,528	36,872
Wenatchee	1,451,098	436,829	50,372
Willamette	1,507,227	327,565	107,802
Winema	980,350	87,690	49,800
Totals:	13,763,093	2,589,477	726,706

[1/] Lands withdrawn from regulated timber harvest by Chief's authority or higher. Data compiled from forest summaries by J. Caswell, 8/30/85.

Management for the Retention and Partial Retention objectives can be compatible with the requirements of the northern spotted owl. The owl's need for large, relatively undisturbed areas for foraging would be in harmony with the visual objectives for landscapes characterized by limited timber harvest. Furthermore, spotted owl habitat is composed of certain structural components of a timber stand, such as standing or downed dead trees, large trees suitable for nests, and shade-tolerant understory. These structural components are compatible with Retention and Partial Retention Visual Management Objectives.

When a landscape is managed for the Modification or the Maximum Modification objective, the evidence of human activities may be dominant. Although modifications are shaped and blended into the landscape to the greatest degree practicable, they are noticeable to the casual observer as being human caused. Of all the visual management objectives, the Modification and Maximum Modification objectives are the least compatible with maintaining spotted owl habitat.

Cultural Resources

Cultural resources are the physical remains of sites, buildings, structures, and objects used by humans in the past, that have historical, archaeological, architectural, engineering, or cultural significance. They are material evidence of past ways of life. A wide range of cultural resources are found on National Forest lands, including prehistoric sites, buildings and structures representing early settlement, commerce, transportation, mining, and lumbering history. The Forest Service has the legal responsibility to identify, evaluate, protect, and enhance significant archaeological and historical properties. The authority for this responsiblity is found in the Antiquities Act of 1906, The National Historic Preservation Act of 1966, as amended, the National Environmental Policy Act of 1969, the National Forest Management Act of 1976, and the Archaeological Resources Protection Act of 1979. Further guidance is found in Title 36 Code of Federal Regulations Part 800 (36 CFR 800) and in 36 CFR 219.24.

The Forest Service must protect significant cultural resources from management activities that could in any way cause a change in the qualities that make a property important. Preservation in place, with little or no site disturbance and retention of the natural qualities of the environment, provides the best protection for all of a property's important values. Such treatment is compatible with management of spotted owl habitat.

American Indian Religious and Cultural Use

The American Indian Religious Freedom Act of 1978 (AIRFA) protects the right of Indians to practice traditional religions including access to religious sites, use and possession of sacred objects, and freedom to worship through ceremonials and traditional rites. Traditional religions are practiced widely on National Forest lands. These religious practices may include the collection and use of a variety of forest resources, such

as certain plant species, for medicinal or ceremonial purposes. Cedar, for example, is an important resource in the rites of some Indian groups west of the Cascade Range. An undisturbed environmental setting is also important for some aspects of traditional religions. Isolation and privacy are preferred for many rituals. In addition to the rights secured to Indians by AIRFA, some other traditional or cultural uses of lands and resources, such as hunting and fishing, gathering edible roots, and picking huckleberries, are rights specified by treaty. The practice of traditional religions can be compatible with spotted owl habitat inasmuch as there is little or no disturbance to the natural qualities of the environment.

Wildlife and Fish

The National Forests of the Pacific Northwest Region are home to many wild animals. Wildlife inhabit all areas of these National Forests, from alpine meadows to canyon rims, and from the more arid regions east of the Cascades to the lush rain forests of the Olympic Peninsula. Many species of fish are found in the lakes and streams of the Region's National Forests. Among these are salmon and steelhead trout which return from the ocean to the National Forests' streams to spawn.

The spotted owl prefers dense old-growth forests. As reported by Meslow and others (1981), the northern spotted owl is an old-growth specialist. This owl and several other species of wildlife reach their greatest population densities in old-growth Douglas-fir forests (Forsman, 1980; Mannan, 1977; Meslow and others, 1981; Franklin and others, 1981) (Refer to Table 3-9).

Management for the spotted owl will affect a number of other species of wildlife that also have special requirements. The amount and distribution of mature and old-growth forest retained for the benefit of the spotted owl will influence the amount of habitat available to other wildlife species. These species include those that inhabit mature and old-growth forests (in addition to the spotted owl), cavity nesters, some game species, and those that inhabit or are associated with riparian areas.

The number of wildlife species using mature and old-growth forests has been determined for western Oregon and Washington. In addition to the spotted owl, over 200 wildlife species use mature and old-growth forests for feeding and breeding, although many of these same species use immature forests for feeding and breeding as well. This is nearly 44 percent of all the species occurring in western Oregon and Washington (USDA Forest Service, 1985). Refer to Figure 3-4.

Several wildlife species find optimum breeding habitat only in mature and old-growth forests. These species include birds, such as the northern goshawk, Vaux's swift, and pileated woodpecker; and mammals, such as silver-haired bat, red tree vole, northern flying squirrel, and marten. (Meslow and others, 1981). (Refer to Table 3-9.)

Inhabitants of riparian areas, both land animals and fish, are also affected by spotted owl management. Spotted owls often nest near or within

riparian areas (Barrows and Barrows, 1978; Barrows, 1981). Maintaining habitat for spotted owls provides areas with much structural diversity in riparian habitats. The structure of vegetation influences the use of this space by wildlife species. Maintenance of old growth for spotted owl habitat in riparian areas also affects fish habitat. Of the various habitats found on the National Forests, riparian areas generally have the greatest density and diversity of wildlife species (Odum, 1979). Of 414 wildlife species in western Oregon and Washington, nearly 359 species use riparian areas or wetlands (USDA Forest Service, 1985). Harris (1984) said that undisturbed riparian habitat is considered necessary as travel corridors for wildlife to link isolated fragments or "islands" of old-growth and mature forest.

Cavity nesting wildlife species use standing dead trees (called snags), as well as partially live ones, for various requirements, such as nesting and feeding. Nearly 100 wildlife species use snags. Over half of these species are dependent on snags for their survival (USDA Forest Service, 1985). Woodpeckers are dependent on snags, and other animals are dependent on the cavities that are created by woodpeckers. The absence of suitable snags can limit populations of wildlife dependent on snags (Balda, 1975; Mannan and others, 1980). Large dead or partially live trees also provide nesting sites for the northern spotted owl. Of 47 nests in Oregon, 30 were found in cavities of old-growth conifers (Forsman and others, 1984). Forested habitats that are maintained for the northern spotted owl will also be available to cavity excavators and cavity nesters. Table 3-10 lists 11 woodpeckers that use Douglas-fir forests. The hairy woodpecker, northern flicker, red-breasted sapsucker, and acorn woodpecker also inhabit shrub and open sapling-pole habitats.

In the Pacific Northwest Region, the ranges of the black-tailed deer and Roosevelt elk overlap, in most cases, with the range of the northern spotted owl. The quantity of areas maintained for the spotted owl, as well as their location, influences habitat for deer and elk. While harvest of forests can provide openings for forage, habitat for the northern spotted owl can provide optimal thermal cover for deer and elk if forest stands have a 70 percent or greater canopy closure (1920 memo of 2/9/83 from Regional Forester). Forest stands considered as optimal cover for deer and elk are those that provide a number of needs for these animals. These needs include: (1) Visual screens for hiding; (2) Thermal cover to mitigate the adverse effects of weather; and (3) Supplemental forage during prolonged periods of adverse weather (USDA Forest Service, 1985).

Two owl species, the barred owl and the great-horned owl, may influence the survival of the spotted owls. The barred owl, Strix varia, has become a competitor with the northern spotted owl for food and nesting sites (Allen and others, 1985). The barred owl has not occurred in large numbers in the Pacific Northwest. Within the last 20 years, however, researchers have noticed an increase in sightings, indicating that the barred owl is expanding its range (Juelson, 1985; Allen and others, 1985; Gutierrez and others, 1984). Another species, the great-horned owl, Bubo virginianus, is a predator of the northern spotted owl. In 1980, Forsman indicated that spotted owls, if they foraged outside of old-growth forests, were at risk to predation by great-horned owls. Both the great-horned owl and barred

owl appear to be able to adapt to a landscape that is a patchwork of forest stands, each with varying ages. Gutierrez and others (1984) state that the potential for competition between spotted and barred owls could be great because barred owls are more efficient in exploiting fragmented forests than northern spotted owls.

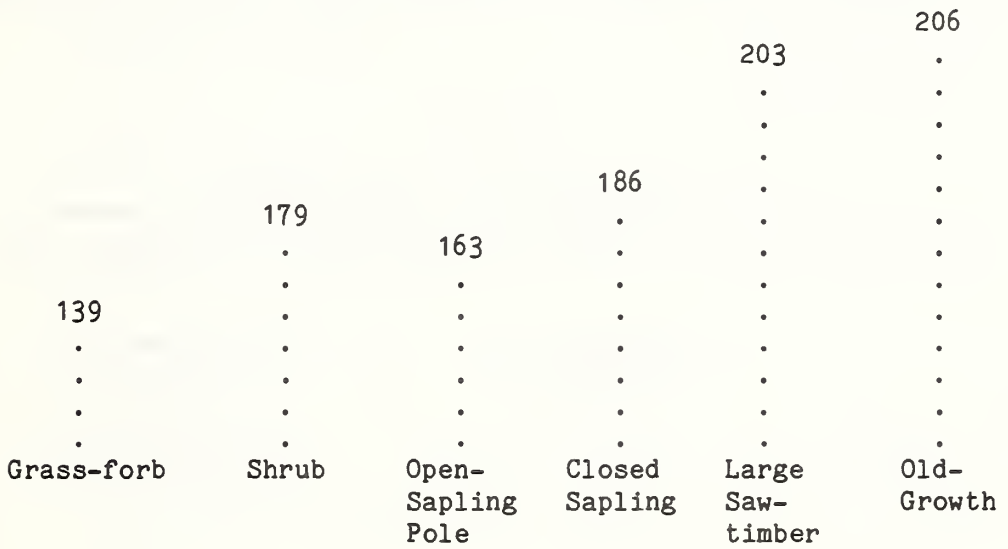


Figure 3-4. Number of Wildlife Species that Breed in Various Forest Conditions in the Pacific Northwest (USDA Forest Service, 1985). A wildlife species may use more than one forest condition for breeding. For example, many of the 206 wildlife species that breed in old growth may also breed in large sawtimber and other stand conditions. Refer to Table 3-9 for a list of species that are closely associated with old growth as their primary breeding habitat (from USDA Forest Service, 1985, Appendix 8).

Range

Livestock grazing is an important activity on a number of the National Forests in the Pacific Northwest Region. Most of the livestock grazing on those National Forests with spotted owls occurs in limited areas. Grazing is done in areas where timber has been harvested, along roadsides, in recently burned-over areas, in the occasional natural opening within stands of timber, and in meadows. Seeding with domestic grasses and forbs or the natural response of the native plants to the disturbances of fire and timber harvest provide the forage. The forage growing in burned and harvested areas is usually available to livestock for 20 years. Habitat preferred by spotted owls is usually not coincident with areas grazed by livestock.

Timber

The 13 National Forests that lie within the range of the northern spotted owl grow magnificant stands of Douglas-fir and other species of timber-producing trees. These National Forests are the heart of the Douglas-fir region. While most of the forest land in ownership other than Federal has been harvested at least once, the 13 National Forests have 10.5 million acres of forested land (including wilderness) that have not been harvested.

Table 3-9

Wildlife Which Reach Greatest Density
for Breeding or Foraging in Old-Growth Douglas-fir Forests
of Western Oregon and Washington (from Meslow and others, 1981)

Birds	Canopy-dwelling Mammals	Ground-dwelling Mammals
Northern goshawk	Silver-haired bat	California red backed vole
Northern spotted owl	Long-eared myotis (bat)	Coast mole
Bald eagle	Long-legged myotis (bat)	Marten
Vaux's swift	Hoary bat	Fisher
Pileated woodpecker	Red tree vole	
Hammond's flycatcher	Northern flying squirrel	
Pine grosbeak		
Townsend's warbler		

The National Forests west of the Cascades are the Mt. Baker-Snoqualmie, Olympic, Gifford Pinchot, Mt. Hood, Willamette, Siuslaw, Siskiyou, Umpqua, and Rogue River. The timber stands on these National Forests are primarily composed of Douglas-fir, western hemlock, and true firs. The true firs include Pacific silver fir, grand fir, noble fir, and alpine fir.

Throughout the Cascades, true firs contribute significantly to the volume of standing timber found at higher elevations. The four National Forests that are east of the Cascades have these stands of true fir, which are typically found at high elevations. Englemann spruce, western larch, lodgepole pine, and white pine are minor components of these timber stands.

Table 3-10

Woodpecker Species Inhabiting Douglas-fir Forests
in Western Oregon and Washington and Snag Diameters
(from USDA Forest Service, 1985)

Woodpecker Species	Size of Snag Most Often Used (inches dbh)
Lewis woodpecker	17+
Acorn woodpecker	17+
Red-breasted sapsucker	15+
Williamson's sapsucker	17+
Downy woodpecker	11+
Hairy woodpecker	15+
White-headed woodpecker	15+
Three-toed woodpecker	17+
Black-backed woodpecker	17+
Northern flicker	17+
Pileated woodpecker	25+

At mid-elevations, forests of Douglas-fir, grand fir, and ponderosa pine appear. On the Winema and Deschutes National Forests, large stands of lodgepole and ponderosa pine are at the lower elevations where the sites are drier. Except for more limited stands of pure lodgepole pine, the Wenatchee and Okanogan National Forests are similar to the Winema and Deschutes in the transition of the composition of timber stands from higher to lower elevations.

Except in the drier ponderosa and lodgepole pine stands east of the Cascades, where owl sightings have been rare, there is habitat for spotted owls throughout these timber stands. Refer to "Physical and Biological Setting" for a more detailed description of spotted owl habitat. A comparison of the total acres of forested land, acres of land suitable for timber production, and acres of suitable owl habitat is presented in Table 3-11.

Spotted owl habitat, as described in the section "Physical and Biological Setting," is found in old-growth and mature stands of timber. This is the

kind of timber which is often most in demand by the timber industry. Extensive harvest of these trees may have an effect on the long term ability of the owl to survive. Any limiting of harvest may have an effect on the economy of the Pacific Northwest. Analyses of these possible effects are found in Chapter 4.

Watersheds and Soils

In any natural community, disasters cause sudden changes in the environment. Habitat for spotted owls may be subject to elimination or significant alteration by disasters such as landslides, floods, and damage from wind storms. Suitable owl habitat located in areas that are susceptible to these disasters probably will not survive over several hundred years. Even if disturbances are sporadic, the amount of an area that is disturbed becomes a limiting factor in the retention of suitable habitat.

Damaging floods occur about once a decade in the Cascade Mountains. These floods usually occur in winter when a warm air mass from the Pacific Ocean moves inland. The key factors which determine whether or not a flood will occur are the duration and magnitude of the rains, the persistence of the warm air mass, and the depth of the snow pack. Areas most affected are within the elevational range of 2000 to 4000 feet. This is the transient snow zone.

The precipitation, topography, and geological origin of certain soils, can lead to naturally high levels of bedload and suspended sediment in some streams. During an unusually severe storm, soils may become saturated with water. This may lead to debris avalanches and mass failure of slopes which scour streams down to bedrock. Evidence of past debris avalanches can be found in the V-shaped stream profiles found throughout the Cascades and Coast Ranges.

Most northern spotted owl habitat is located in the transient snow zone. The floods change the owl habitat in different ways. They occasionally topple large trees. They promote landslides, scour the toe of slopes, and build debris dams. They change the dominant vegetation from conifers to hardwoods and shrubs.

Winter storms sometimes have winds of high velocity. These winds can uproot trees or even entire stands of mature and overmature trees. There is little documentation on the frequency of such windstorms. Nevertheless, experience suggests that probably one major windstorm every ten years causes losses from blown down trees over an area exceeding 1000 acres.

Minerals and Rock Resources

The Bureau of Land Management and the Geological Survey have the primary responsibility for the management of minerals on Federally administered lands. However, by means of various laws, regulations, and interdepartmental agreements and rules, the Forest Service has some

authority and responsibility concerning the development of minerals on National Forest lands. Often the Forest Service monitors the effects of mining on the surface resources.

The 1872 Mining Law gave United States citizens a statutory right to prospect for, locate, and develop minerals on lands open to such entry. When the National Forest System was established in the early 1900's, mining was considered a use of the National Forests.

Minerals are generally divided into three classes:

1. Locatable minerals: These are any metallic or nonmetallic hardrock minerals that are recognized as having value and which are locatable under the general mining laws. Gold, silver, zinc, nickel, and mercury are examples.

2. Leasable minerals: These can be acquired through the Mineral Leasing Act of 1920 and usually involve large tracts of land. Examples are coal, oil and gas, oil shale, geothermal activity, phosphorus, potassium, sulphur, and sodium.

3. Mineral materials: These are "saleable minerals" as defined in the Materials Act of 1947. Examples include common varieties of stone, sand, gravel, and clay.

As a manager of the surface resources, the Forest Service protects these resources, both during and after mining. As such, each National Forest requires the operators to comply with mining laws and regulations. The National Forests also investigate unauthorized uses on mining claims.

Mineral development and use is usually integrated with management of the surface resources. In some cases, mining is not permitted in order to protect important surface resources. For instance, mining is not permitted in research natural areas or designated wildernesses.

Spotted owl habitat is a surface resource. It is possible that prospecting or developing minerals could modify habitat areas or characteristics of forest stands. Withdrawal of certain areas from mineral entry could be necessary if there are effects that cannot be ameliorated.

Energy Resources

The Cascade Mountains are of volcanic origin. Heat from volcanic activity is a possible source of energy. A number of National Forests in the Region have usable geothermal resources. Indications are that this Region has a much higher potential for geothermal development than most of the rest of the United States.

The filing of lease applications for geothermal exploration was first permitted in January, 1974, on "Geothermal Energy Specified" public lands. Later, the U.S. Geological Survey established areas, called Known Geothermal Resource Areas, on several National Forests within the Pacific

Northwest Region. Geothermal exploration, to date, has been localized, with little disturbance to each site. The location of drilling sites for exploration has been flexible; therefore, environmentally sensitive sites usually have been avoided.

Table 3-11

Suitable Spotted Owl Habitat and
Timber Suitability Comparisons

National Forest	Forested Acres	Technically Suitable Timber Acres[1/]	Suitable Owl Acres[2/]	Suitable Owl/TM Acres[3/]
Deschutes	1,367,300	1,148,700	26,200	22,100
Gifford Pinchot	1,161,206	939,585	489,900	448,500
Mt. Baker-Snoqualmie	1,308,400	604,800	561,900	276,550
Mt. Hood	832,241	647,118	346,000	256,000
Okanogan	1,487,330	703,200	217,330	15,000
Olympic	599,733	485,425	131,000	143,794
Rogue River	559,829	414,674	51,000	28,000
Siskiyou	1,035,508	625,442	375,000	297,000
Siuslaw	581,515	537,746	33,917	17,529
Umpqua	891,356	755,109	453,530	358,395
Wenatchee	1,451,098	791,899	148,507	89,315
Willamette	1,507,227	1,005,396	686,954	485,619
Winema	980,350	834,800	112,200	46,700
TOTAL	13,763,093	9,493,894	3,633,438	2,484,502

1/ Lands technically suitable for timber production are taken from each National Forest's Analysis of the Management Situation.

2/ The total acres of currently suitable northern spotted owl habitat as inventoried in 1985. This total includes lands suitable and not suitable for timber production.

3/ The acres of suitable northern spotted owl habitat that are also suitable for timber production.

After a geothermal source is located and a deep test well proposed, there is less flexibility in locating a site. Any spotted owl management area that might be in the same location as a well site may be affected. The activities associated with development of the site may alter owl habitat.

Many of the National Forests in the Region have potential sites for small hydroelectric production. While the eventual development of these sites is possible, there is presently a surplus of electric energy in the Pacific Northwest. High electrical prices, slowing of the economic growth rate, and the success of conservation efforts have caused a decrease in energy consumption since the early 1970's. Requests for development of lowhead hydropower production on streams with 3 to 25 megawatt capacities had been rising. They have now leveled off. Whatever the future of low level hydroelectric development on streams in the National Forests of the Region, the effect of this development on spotted owl habitat is not known.

The collection of firewood from the National Forests has increased in popularity in the past 15 years. Between 1970 and 1979, some National Forests had an increase in requests for firewood permits as high as 1000 percent. Most firewood is used for home heating. Regulation of wood-burning stoves to preserve air quality may change trends in consumption. Firewood is primarily taken from the woody residue left from timber harvesting and from trees that died from insect infestations. Firewood programs usually do not affect spotted owl habitat.

Fire

The Forest Service actively suppresses wildfires. One of the benefits to owls of active fire suppression is that more coniferous forests will grow into older age classes than normally would if fires had been allowed to burn naturally. Morris' (1934) documentation of wildfires shows that those experienced by the pioneers in the western Cascades and the Coast Range were generally extensive and destructive, though not as frequent as fires east of the Cascades.

Residual groups of trees from the overstory or scattered individual trees may survive these destructive fires of the west side. This happens when the fire burns across the ground rather than through the tree canopy. This fire behavior often occurs in humid environments such as those found on north-facing slopes, along riparian areas, and on lower slopes of canyons. These residual trees and groups of trees, whether they originate from fire suppression or the behavior of wildfires, continue to grow into the older age classes presently identified as probable spotted owl habitat.

More recently, fire has been used as a management tool in abating slash, preparing seedbeds, and controlling the stocking of tree understories. Slash abatement is often done after harvesting by both the clearcut and shelterwood methods. Habitats created by these harvesting methods are rarely used by northern spotted owls as foraging areas.

Prescribed burning can modify the structure and species composition of the trees in the understory. It can also alter the species composition of the

ground vegetation, the effects of which can last for nearly two decades following treatment. Changes in vegetation may affect the habitat of ground-dwelling prey species. Whether foraging behavior of the owls is being significantly affected by the burning or by the changes in abundance of prey species, or both, is not known.

Chapter 4

ENVIRONMENTAL CONSEQUENCES

OVERVIEW

This chapter describes the potential effects of implementing the alternatives developed to maintain a viable population of northern spotted owls. The discussion includes the physical, biological, social, and economic consequences of each alternative.

The following discussion of the environmental effects is general rather than specific to any particular National Forest or community. The standards and guidelines do not specify land uses, nor do they specify actions to be taken on any specific land area in the Region. Rather, they guide the decisions that are made in individual National Forest Land and Resource Management Plans (Forest Plans) regarding what actions are to be taken concerning a specific area.

PHYSICAL AND BIOLOGICAL EFFECTS

Northern Spotted Owl Viability

The implementing regulations of the National Forest Management Act of 1976 require the Forest Service to plan the management of fish and wildlife habitats to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR 219.19). This section describes the effects of the management alternatives on the viability of the northern spotted owl.

What is viability?

A viable population is defined as "one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area" (36 CFR 219.19). This regulation places clear focus on both the number and distribution of reproductive individuals in the population, and it clarifies the goal as being to "insure...continued existence" of the population.

The regulation does not specify the number of years for which continued existence of a species ought to be planned or the degree of certainty that should be accepted as insuring continued existence. The dynamic nature of both species and environments does not allow 100 percent assurance that a species will continue to exist indefinitely. There is not a single fixed size of population above which a species is viable and below which the species will become extinct. Rather, different sizes of population carry

different degrees of risk of extinction. For this reason, viability must be expressed as a relative term rather than an absolute one.

The analysis of population viability, as well as terms for its expression, have been discussed in a number of recent publications (Frankel and Soule, 1981; Schonewald-Cox, 1983; Shaffer 1981; Soule and Wilcox, 1980). There is general agreement that viability should be expressed as the probability of persisting to a specified time in the future. There is also agreement that analyzing long-term viability requires looking at least 100 years into the future and perhaps as much as 1000 years. There is much less agreement, however, on the actual combination of probability of continued existence and the period of time that should be used to define a viable population.

Table 4-1

Features of Each Alternative

ALT.	Suitable Owl Habitat (acres)	Owl Habitat Area Size (avg. acres)	Dist. Between Habitat Areas (miles)	No. Designated Habitat Areas (each)	Habitat In Suit. Timber (acres)
A	1,100,000	0	--	0	0
B	1,124,897	300	6-12	206	24,897
C*	1,177,343	300	6-12	417	77,343
D	1,413,839	1000	6-12	550	313,839
E	1,609,779	1000	6-12	810	509,779
F**	1,413 839 1,790,446	1000- 2200	6-12	550	313,839- 690,446
G	1,790,446	2200	6-12	550	690,446
H	2,048,246	2200-OR 4400-WA	6-12	620	948,246
I	2,220,306	6600	4-12	797	1,120,306
J	2,490,366	2200	3-12	1000	1,390,366
K	2,937,211	2900	3-12	1000	1,837,211
L	3,718,125	--	--	1220	2,618,125

*No action alternative **Preferred alternative

Because there is no precise definition of viability, this analysis was conducted as a risk analysis. The intent was to assess the likelihood that northern spotted owl populations would persist to specified years in the future. This was done for each of the management alternatives. The probability of persistence is an expression of both the likelihood that the owl population will escape factors that could cause extinction and the scientific uncertainty surrounding the information available about the owl.

What are the major risk factors for spotted owl populations?

Total habitat available for the northern spotted owl has been declining and will continue to decline as mature and old-growth forest stands are harvested. As the amount of habitat declines it also becomes more fragmented, making it more difficult for both juvenile and adult owls to move from one patch of suitable habitat to another. This increases the risk that one part of the owl population will be isolated from another or that a large portion of the remaining suitable habitat will not be occupied by owls. The overall result of the decline in habitat and the increasing fragmentation of habitat is an increased risk that the northern spotted owl will become extinct in all or part of its range. Extinction would most likely result from one of the three processes shown below:

1. Variability of birth and death rates through time.

2. Loss of genetic variation.

3. Catastrophes and unforseen events.

Each of these factors can cause either local or widespread crashes and ultimate extinction of a population. The risk that any of these processes would cause extinction increases as the amount of habitat declines and becomes more fragmented. It was these processes in conjunction with the reduction in habitat that were considered in this analysis.

Birth and death rates are part of the overall demographics of a population. Other demographic factors include the age at first reproduction, sex ratio, and life expectancy. This whole complex of factors determines the rate of increase or decline in a population. Variations in birth and death rates produce changes in total numbers of animals over time. Severe or long-lasting periods of low reproduction can threaten a species with extinction (Shaffer, 1981). This risk is greatest for species that are long-lived and that have few individuals, large home ranges, and low recruitment rates.

Genetic factors also influence population viability (Frankel and Soule, 1981; Soule and Wilcox, 1980). Reductions in genetic variability appear to reduce the fitness of most species. This is most directly expressed in reduced reproduction and survival rates. A decrease in genetic variability also reduces the species ability to adapt to environmental change. Decreases in genetic variability are most likely to have significant effects in small isolated populations.

Catastrophic and unexpected events that could affect viability of the spotted owl fall into two categories. The first category is catastrophic loss of habitat from fires, windstorms, volcanic eruptions, and floods. The risk of losing habitat because of these events is influenced by the size and distribution of the habitat areas. The risk of losing very large amounts of habitat to fires is probably greatest in large, unbroken blocks of old-growth and mature habitat. But the risk of losing most or all of a specific habitat area to fire is greatest for small blocks of old-growth and mature habitat. Risk of habitat loss caused by windstorms is greatest for small stands of old-growth and mature trees set in a landscape of younger-age stands (Ruediger, 1985). Risk of habitat loss from volcanic eruption and flood is not influenced by the size of the habitat area, but the overall distribution of habitat areas would determine whether such losses were significant to the overall spotted owl population.

The second category of catastrophes and unexpected events are biological interactions of unprecedented magnitude. One such possible interaction could be caused by the continuing expansion of the range of the barred owl (Strix varia) into the Pacific Northwest (Taylor and Forsman, 1976; Allen and others, 1985; Hamer and Allen, 1985). Allen and others (1985) suggested that the invading barred owls may be outcompeting spotted owls in some habitats. They speculated that the balance of competition is most favorable to spotted owls in large, unbroken blocks of habitat on mid- to upper-slopes.

Analytical procedure for assessing viability

The procedure used to assess viability under each alternative involved:

1. Estimating current and future amounts of spotted owl habitat and its capability to support owls.

2. Estimating the likelihood that owl populations would become isolated from each other.

3. Estimating the likelihood that owl populations would survive demographic, genetic, and catastrophic risks.

4. Summarizing results of the assessments in terms of the probability of continued existence of the species to specified times in the future.

The analysis process is presented in detail in Appendix B.

Results of the viability analysis

Habitat capability. Estimates of current and future capability of habitats to support pairs of spotted owls are displayed in Tables 4-3 through 4-15. Table 4-3 displays the capabilities to support northern spotted owls that will be provided through time on federal lands in addition to the National Forests of the Pacific Northwest Region. These were treated as constants across all alternatives and time periods. Capabilities to support pairs of owls on National Forests in the Pacific Northwest Region are displayed for

the alternatives in Tables 4-4 through 4-15. Capabilities from Table 4-3 were added to capabilities for Pacific Northwest Region National Forests in Tables 4-4 through 4-15 for the purposes of the viability analysis.

Tables 4-4 through 4-15 also display estimates of the trend for both the total population of the northern subspecies of the spotted owl and of the California subspecies in the Sierra Nevada mountains. The accuracy of the totals on Tables 4-4 through 4-15 resulting from combining habitat capability estimates with population trends is unknown. The numbers used to display population trends are presented in more detail in Table 4-2. These figures differ from the figures used in the viability analysis for these other federal lands (Table 4-3) because (1) the figures in the viability analysis include only those habitats that are designated to be maintained over time; (2) the figures used in the viability analysis apply an estimated occupancy rate to the habitat areas on BLM areas and National Forests in California; and (3) the figures used in the viability analysis do not include the California subspecies in the Sierra Nevadas. The potential contribution of the California subspecies to viability of the northern subspecies is uncertain (see later section on Habitat of California subspecies and demarcation from northern subspecies). This question will receive fuller attention in the final EIS. In reviewing the present document, note that the figures actually used for the viability analysis were a combination of the habitat capability for National Forests in Oregon and Washington from Tables 4-4 through 4-15 and the capabilities for other Federal lands displayed in Table 4-3.

The figures for Pacific Northwest Region National Forests in Tables 4-4 through 4-15 represent the predicted capability of habitats to support pairs. They are measures of habitat and should not be interpreted as predictions of population. The presence of habitat does not assure the presence of owls. For example, Alternatives A, B, and C display capabilities to support owls on the Olympic Peninsula in years 100 and 150, but the probability of the owl population persisting to year 100 on the peninsula is rated as very low (Table 4-16) under these alternatives. There are two likely causes for the local extinction of the owl population in the Olympic Peninsula under these alternatives. The first cause is the increasing fragmentation of habitat which reduces the likelihood that owls will repopulate areas that are vacated when individual owls die. The second cause is the occurrence of periods of low reproduction and high mortality. These low points in reproduction can cause an irreversable decline in a population whose numbers have already dropped because of habitat reduction. Thus, the results of the viability analysis suggest that local extinction of the Olympic Peninsula population is likely to occur under these alternatives, even though suitable habitat would continue to be present. This emphasizes the need to distinquish between habitat capability and actual population projections.

Table 4-2

Estimated Number of Pairs of the Northern and California Subspecies That Could Be Supported Through Time on Federal Lands, Excluding the National Forests in the Pacific Northwest Region

Physiographic Province	Category of Land	Year 0	15	50	100	150
Olympic Peninsula	National Park [1]	37	37	37	37	37
Washington Cascades	National Parks [1]	17	17	17	17	17
Oregon Cascades	National Parks [1]	7	7	7	7	7
	BLM [2]	28+	28+	28	28	28
Klamath	National Forest in CA [3]	830	500	249	249	249
	National Parks [4]	31	31	31	31	31
	BLM in CA [5]	25		Unavailable		
	BLM in OR [2]	9+	9+	9	9	9
Oregon Coast Range	BLM [2]	42+	42+	42	42	42
Total estimated pairs of the northern subspecies		1026	671	420	420	420
Sierra Navadas	National Forest in CA [3]	730	440	265	265	265
	National Parks [4]	59	59	59	59	59
	BLM [5]	22		Unavailable		
Total estimated pairs of the California subspecies		811	499	324	324	324
Total of both subspecies		1837	1170	744	744	744

[1] These are habitat-based estimates of capability to support pairs of spotted owls. See Appendix B for derivation.

[2] Numbers shown for BLM areas in Oregon are the number of designated spotted owl habitat areas that will be maintained under current plans. At the current time, there is additional capability to support spotted owls. Charles Bruce, Oregon Department of Fish and Wildlife, Corvallis, OR, estimates that there are currently 250-300 spotted owl sites on BLM areas in Oregon (personal oommunication, July 15, 1986). This includes the Oregon Cascades, Klamath, and Oregon Coast Range provinces. This estimate is based on an approximate 30 peroent reduction from the total of 400 sites located between 1969 and 1984. The total number of these sites that are currently occupied or are capable of supporting breeding pairs is unknown. In 1985, the BLM surveyed 278 sites and found 118 of them occupied by pairs of spotted owls and 59 occupied by single spotted owls (Bill Nietro, BLM, Portland, OR, personal communication, July 7, 1986). The number that will actually remain at year 15 is unknown.

[3] Current year figures are estimates of total current capability to support pairs of spotted owls based on data available as of January 1986. Source: Gordon Gould, California Department of Fish and Game (CDFG), Sacramento, CA (personal communication, July 14-15, 1986). Figures for later years are based on personal communication with Dale Avant, Forest Service, San Franoisoo, July 14, 1986. The figures at year 15 represent a 40 percent reduction from current levels. The figures for later years represent the count of designated spotted owl habitat areas plus additional capability on reserved lands.

[4] Figures are estimates of current capability to support pairs of spotted owls (Gordon Gould, CDFG, personal communication, July 14-15, 1986).

[5] Current year figures are estimates of total current capability to support pairs of spotted owls based on data available as of January 1986 (Gordon Gould, CDFG, personal communication, July 14-15, 1986). No estimates are available of habitat that will remain over time.

Table 4-3

Capability to Support Pairs of Spotted Owls on Habitat that will be Provided Through Time on National Parks, National Forests in California, and Bureau of Land Management areas Under Any Alternative[1/]

Capability Figures were Treated as Constants Across all Alternatives and Time Periods.

Physiographic Province	National Parks	BLM	National Forests in CA[2/]	Total
Olympic Peninsula	37			37
Washington Cascades	17			17
Oregon Cascades	7	20		27
Klamath		6	195	201
Coast Range		30		30
Total	61	56	195	312

[1/] These figures are based on habitat located in National Parks in Oregon and Washington; areas designated for management of spotted owls on National Forests in northern California; and areas designated for management of spotted owls on Bureau of Land Management areas in Oregon and Washington.

[2/] Only within the range of the northern spotted owl.

Predictions of habitat capability used in the viability analysis include habitat in Washington, Oregon, and northern California. The capabilities displayed in Table 4-3 are based on habitat located in National Parks in Oregon and Washington; areas designated for management of spotted owls on National Forests in northern California; and areas designated for management of spotted owls on Bureau of Land Management areas in Oregon and Washington. The predictions displayed in Tables 4-4 through 4-15 for National Forests in Oregon and Washington are based on suitable habitat that falls into one of the following catagories:

1. Lands that are designated to be managed for spotted owl habitat.

2. Lands that are reserved from timber harvest.

3. Lands that are scheduled for timber harvest but will not have been harvested at the specified date.

4. Lands that are technically not suitable for timber harvest.

The current tabulation and future estimation of habitat capability are summarized within physiographic provinces as classified by Franklin and Dryness (1973) and modified for use in this project. Provinces were used because the locations at which populations of owls could become isolated in the future coincided well with province boundaries. Five general provinces were considered: the Olympic Peninsula, the Washington Cascades (a composite of the Northern Cascades, southern Washington Cascades, and the western fringe of the Okanogan Highlands), the Oregon Cascades (a composite of the Western Cascades and the High Cascades), the Klamath Mountains (which included southwestern Oregon and northwestern California), and the Oregon Coast Range.

Capability figures used in the viability analysis for National Forests in California and Bureau of Land Management lands in Oregon and Washington (Table 4-3) were based on the number of areas designated for spotted owl management and the reported occupancy rate of those areas. For National Parks, the total reported acres of suitable habitat were divided by the average acres in a home range for a pair of owls. The results of this calculation were used as the capability to support a pair of owls. Capability to support owls on National Forests in Oregon and Washington was determined by applying a habitat suitability index (HSI) to predicted acres of suitable habitat. The HSI describes the probability that a site is capable of supporting a pair of owls, given that the site has a particular acreage of suitable habitat within a home range area. For example, the HSI suggests that 1000 acres of suitable habitat is less than half as likely to support a breeding pair of owls than is 2200 acres of suitable habitat. According to the HSI, an area of at least 2700 acres of suitable habitat is needed to have the maximum likelihood of supporting a breeding pair of owls. The HSI is displayed in Figure B-1 (page B-5) and its derivation and application are further explained in Appendix B.

Table 4-4

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative A. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	35	12	11	11
Washington Cascades	443	300	168	116	118
Oregon Cascades	587	398	154	115	108
Klamath	126	93	23	18	18
Oregon Coast Range	13	6	2	2	2
Total for National Forests in OR and WA[1/]	1248	832	359	262	257
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2002	1103	1006	1001

[1/] Predictions of habitat capability on National Forests in Oregon and Washington in this table and the following tables are based on suitable habitat that falls into one of the following catagories: (1) lands that are designated to be managed for spotted owl habitat; (2) lands that are reserved from timber harvest; (3) lands that are scheduled for timber harvest but will not have been harvested at the specified date; and (4)

lands that are technically not suitable for timber harvest. These predictions were derived using the procedure for habitat capability analysis described in Appendix B.

2/ These estimates were derived from a variety of sources. They are based on surveys of owl sites, projections of depletion in habitat over time, and counts of designated habitat areas. Table 4-2 provides an explanation of sources and assumptions for these estimates.

3/ These totals combine both habitat-based and population-based estimates, thus their accuracy is unknown. They are presented to give a general idea of the likely trend for spotted owls in the area considered. They also combine the northern and California subspecies of the spotted owl. Contribution of the California subspecies to the viability of the northern subspecies is uncertain (see additional discussion in this chapter). These numbers were not used in the viability analysis. Numbers that were actually used in that analysis were a combination of habitat capability estimates for National Forests in Oregon and Washington and the estimates for other Federal lands displayed in Table 4-3.

Table 4-5

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative B. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	35	12	11	11
Washington Cascades	443	300	169	118	120
Oregon Cascades	587	400	158	120	112
Klamath	126	95	27	22	22
Oregon Coast Range	13	6	3	3	3
Total for National Forests in OR and WA[1/]	1248	836	369	274	268
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2006	1113	1018	1012

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-6

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative C. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	38	13	12	12
Washington Cascades	443	306	176	135	127
Oregon Cascades	587	414	181	143	136
Klamath	126	93	25	20	20
Oregon Coast Range	13	8	5	5	5
Total for National Forests in OR and WA[1/]	1248	859	400	315	300
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2029	1144	1059	1044

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-7

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative D. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	43	21	20	20
Washington Cascades	443	335	219	192	174
Oregon Cascades	587	431	218	185	177
Klamath	126	96	31	26	26
Oregon Coast Range	13	12	12	12	12
Total for National Forests in OR and WA[1/]	1248	917	501	435	409
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2087	1245	1179	1153

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-8

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative E. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Physiographic Province	Capability to support pairs of owls by year: Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	44	22	21	21
Washington Cascades	443	334	225	193	181
Oregon Cascades	587	463	277	252	245
Klamath	126	99	38	36	36
Oregon Coast Range	13	13	13	16	16
Total for National Forests in OR and WA[1/]	1248	953	575	518	499
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2123	1319	1262	1243

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-9

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative F. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas. This is the Preferred Alternative.[1/]

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	45	21-30	20-29	20-29
Washington Cascades	443	335	219-243	192-213	174-205
Oregon Cascades	587	441	218-271	185-250	177-244
Klamath	126	96	31-38	26-36	26-36
Oregon Coast Range	13	12	10	10	10
Total for National Forests in OR and WA[2/]	1248	929	501-592	435-538	409-524
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[3/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[3/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[4/]					
Total	3085	2099	1245-1336	1179-1282	1153-1268

1/ Results are presented as a range because the alternative includes options to either maintain 1000-acre habitat areas or 2200-acre habitat areas after the first decade.

2/ Predictions of habitat capability on National Forests in Oregon and Washington in this table and the following tables are based on suitable habitat that falls into one of the following catagories: (1) lands that are designated to be managed for spotted owl habitat; (2) lands that are reserved from timber harvest; (3) lands that are scheduled for timber harvest but will not have been harvested at the specified date; and (4) lands that are technically not suitable for timber harvest. These predictions were derived using the procedure for habitat capability analysis described in Appendix B.

3/ These estimates were derived from a variety of sources. They are based on surveys of owl sites, projections of depletion in habitat over time, and counts of designated habitat areas. Table 4-2 provides an explanation of sources and assumptions for these estimates.

4/ These totals combine both habitat-based and population-based estimates, thus their accuracy is unknown. They are presented to give a general idea of the likely trend for spotted owls in the area considered. They also combine the northern and California subspecies of the spotted owl. Contribution of the California subspecies to the viability of the northern subspecies is uncertain (see additional discussion in this chapter). These numbers were not used in the viability analysis. Numbers that were actually used in that analysis were a combination of habitat capability estimates for National Forests in Oregon and Washington and the estimates for other Federal lands displayed in Table 4-3.

Table 4-10

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative G. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	47	31	30	30
Washington Cascades	443	337	247	217	231
Oregon Cascades	587	460	280	262	253
Klamath	126	99	38	36	36
Oregon Coast Range	13	9	9	22	22
Total for National Forests in OR and WA[1/]	1248	952	605	567	572
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2122	1349	1311	1316

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-11

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative H. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.
Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	47	35	35	35
Washington Cascades	443	340	254	230	259
Oregon Cascades	587	460	280	262	253
Klamath	126	99	38	36	36
Oregon Coast Range	13	9	9	22	22
Total for National Forests in OR and WA[1/]	1248	955	616	585	605
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2125	1360	1329	1349

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-12

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative I. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Physiographic Province	Capability to support pairs of owls by year: 0	15	Year 50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	55	47	47	47
Washington Cascades	443	374	304	280	304
Oregon Cascades	587	492	332	327	319
Klamath	126	105	56	56	56
Oregon Coast Range	13	13	13	39	39
Total for National Forests in OR and WA[1/]	1248	1039	752	749	765
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2209	1496	1493	1509

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-13

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative J. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	59	55	55	55
Washington Cascades	443	367	299	277	313
Oregon Cascades	587	549	437	435	427
Klamath	126	107	60	60	60
Oregon Coast Range	13	13	13	36	36
Total for National Forests in OR and WA[1/]	1248	1095	864	863	891
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2265	1608	1607	1635

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-14

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative K. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	67	65	65	65
Washington Cascades	443	376	323	357	356
Oregon Cascades	587	534	476	490	496
Klamath	126	110	70	70	70
Oregon Coast Range	13	13	13	36	36
Total for National Forests in OR and WA[1/]	1248	1100	947	1026	1031
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2270	1691	1770	1775

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Table 4-15

Predicted Capability of National Forests in Washington and Oregon to Support Pairs of Northern Spotted Owls in Alternative L. An Estimate of Spotted Owl Pairs (Northern and California subspecies) is Displayed for Other Federal Lands in Washington, Oregon, Northern California, and the Sierra Nevadas.

Capability to support pairs of owls by year

Physiographic Province	Year 0	15	50	100	150
Habitat Capability for National Forests in Oregon and Washington					
Olympic Peninsula	79	79	79	79	79
Washington Cascades	443	443	443	443	443
Oregon Cascades	587	587	587	587	587
Klamath	126	126	126	126	126
Oregon Coast Range	13	13	13	100	100
Total for National Forests in OR and WA[1/]	1248	1248	1248	1294	1294
Estimated number of pairs of the northern subspecies on Federal lands in Washington, Oregon, and Northern California, excluding the National Forests in the Pacific Northwest Region.[2/]					
Total	1026	671	420	420	420
Estimated number of pairs of the California subspecies on Federal lands in the Sierra Nevadas.[2/]					
Total	811	499	324	324	324
Total of habitat capability for northern spotted owls on National Forests in Washington and Oregon combined with estimated pairs of both the northern and California subspecies on other Federal lands in Washington, Oregon, Northern California, and the Sierra Nevadas.[3/]					
Total	3085	2418	1992	2038	2038

1/ See footnote 1 on Table 4-4.
2/ See footnote 2 on Table 4-4.
3/ See footnote 3 on Table 4-4.

Habitat occupancy and population isolation. Occupancy of habitat and isolation of populations were investigated using both a simulation model and a procedure based on mapping. Results of the habitat-occupancy simulation model are displayed in Appendix B in Table B-8. This model suggests that the rate of occupancy of habitat areas would decline under any alternative except Alternative L. This decline results from the species' apparently low reproductive rate and the mortality of dispersing juveniles. The model predicts that the mortality of dispersing juveniles will increase whenever the density of habitat areas decreases. These results were used in establishing the probabilities of persistence under each alternative.

Results from the analysis of habitat occupancy were combined with the analysis of the maps of habitat areas. The purpose was to predict the effectiveness of the overall habitat distribution in providing for a single interbreeding population across the whole range of the northern spotted owl. If some part of the population becomes isolated from the rest, that smaller, isolated population then has a lower chance of surviving demographic and genetic risks.

Results of this analysis suggest that the population on the Olympic Peninsula may be isolated under all alternatives. This is because the gap between Olympic Peninsula habitats and Washington Cascade habitats is nearly equal to the maximum distance that juveniles have been observed to travel from the place of their birth. Another major gap in distribution occurs at the Columbia Gorge, which could isolate the population in Washington from the population in Oregon. This analysis investigated the possibility that the Gorge isolates the populations, but no firm conclusions were reached. The question of whether the Gorge is a barrier to dispersal remains open. This question is important enough that the over-all viability analysis was done twice; first, assuming that the Gorge is a barrier and then second, assuming that it is not. See Tables 4-17, 18, and 19 for the results of these assumptions.

The other gap in distribution occurs under Alternatives A and B between the Oregon Coast Range and both the Klamath Province and the Oregon Cascades. The rapid reduction in habitat on National Forests under these alternatives would disrupt habitat distribution to the point where dispersal between the Coast Range and either the Klamath or Oregon Cascades provinces would be unlikely.

Variations in birth and death rates. In all alternatives, the greatest risk to owl populations appears to be the risk from reduction in habitat combined with low birth and survival rates and from random variations in those rates. The possible severity of this risk to the owl population is displayed by Figure 4-2. This figure is a projection of the owl population generated by using the currently reported information on owl birth and survival rates. It suggests total extinction of the northern subspecies in 20 to 30 years, even if habitat is not further reduced. It is similar to the prediction made by Lande (1985) that was based on demographic information available at the time of his analysis.

Other evidence is available that suggests that the spotted owl population is not declining as rapidly as depicted in Figure 4-2. It is estimated that the spotted owl population in western Oregon has been declining about 1.1 percent per year over the past decade. (Refer to Appendix C, page C-5.) This rate of decline could be attributed largely to habitat reduction. It suggests that the average birth and survival rates of the population have been more favorable during the last ten years than the observed rates used to generate the curve displayed in Figure 4-2.

The population predictions used in the current analysis were based on the supposition that the average population trend of the spotted owl is relatively stable under current habitat conditions, but that periods of low reproductive success will occur at random intervals in the future. These periods of poor reproduction could lead to population decline or even extinction. The currently observed birth and survival rates were treated as being representative of one of these periods of low reproduction. Significantly higher birth and survival figures were used for long-term averages in population predictions (Appendix B).

In this analysis, differences among alternatives were based on the sizes of the populations that could potentially be supported by the habitat maintained under each alternative. These potential population sizes were used as starting points to project changes in the population into the future. These projections included random periods of low and high reproductive success, as discussed above. Smaller populations are at much greater risk from periods of low reproduction than are large ones. The analysis presented here must, however, be viewed in light of the projection shown in Figure 4-2. There is not adequate evidence available to either confirm or deny that projection and it serves as a caution for interpretation of this analysis.

Results of the demographic analyses are displayed in Figures B-3 through B-7. These results suggest that, under any alternative, the small and possibly isolated population on the Olympic Peninsula is at risk from demographic variation. Even if all current habitat were maintained, there is a high likelihood that this population could become extinct within 100 years. The primary reason is the variations in birth and death rates. The results for populations in the other physiographic provinces are more favorable. They suggest that several alternatives provide a high probability of the owl population surviving demographic risk for 100 to 150 years.

Genetic risks. Results of genetic inbreeding analysis for different population sizes are shown in Table B-21. Population sizes in this table are corrected to the genetically effective population size as explained in Appendix B. The results are presented as an inbreeding coefficient which expresses the degree to which individuals in the population are related to each other.

To place these results in perspective, Frankel and Soule (1981) suggest that an inbreeding coefficient of 0.5 or greater indicates an excessive loss of genetic variability and would result in reduced reproductive fitness. The results suggest that this level of inbreeding would be

observed only in small populations and only after several centuries. The conclusion drawn from these results is that, in virtually all cases, the loss of genetic variability will pose a less serious risk than will the variation in birth and death rates. Loss of genetic variability, however, may interact with birth and death rate variability to generate a more serious risk than either of these factors considered alone. For this reason, the degree of inbreeding was carried forward into the assessment of overall probability of persistence.

VERY HIGH (VH): Continued existence of a well-distributed population on the planning area at the future date is virtually assured. There is latitude for catastrophic events affecting the population or for findings that the species is less flexible in its habitat requirements or that demographic or genetic factors are more significant than were assumed in the analysis.

HIGH (H): There is a high likelihood of continued existence of a well-distributed population on the planning area at the future date. There is limited latitude for catastrophic events affecting the population or for biological findings that the population is more susceptible to demographic or genetic factors than was assumed in the analysis.

MODERATE (M): There is a moderate likelihood of continued existence of a well-distributed population on the planning area at the future date. There is no latitude for catastrophic events affecting the population or for biological findings that the population is more susceptible to demographic or genetic factors than was assumed in the analysis.

LOW (L): There is a low likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic, demographic, or genetic factors are likely to cause extirpation of the species from parts or all of its geographic range.

VERY LOW (VL): There is a very low likelihood of continued existence of a well-distributed population on the planning area at the future date. Catastrophic, demographic, or genetic factors are highly likely to cause extirpation of the species from parts of or all of its geographic range.

Figure 4-1. The Classes of Probability of Persistence of a Well-Distributed Population.

Probabilities of persistence. Overall results of the viability analysis are presented in Tables 4-16 through 4-20. These tables display, for each alternative, the probability of persistence of a well-distributed owl population to specified times in the future.

The probability of persistence may be thought of as the probability of avoiding the various causes of extinction up to a specific time period. The actual factors considered in assigning probabilities of persistence were:

1. The likelihood that the population would survive demographic risk.

2. The degree of inbreeding that would occur.

3. Effects of habitat size and quality on probability of use and distribution of breeding individuals.

4. The effect of habitat distribution on the colonization and occupancy of habitats by breeding individuals.

The probability of catastrophic loss of habitat and of severe competition with barred owls were considered in assigning values for habitat areas of different sizes. Table B-23 (Appendix B) shows the factors that were used in assigning probabilities of persistence and the values for those factors that were assigned to each of the probability classes. The definitions of the overall probability levels are displayed in Figure 4-1.

Tables 4-16 through 4-19 display, for the population of single physiographic provinces or groups of provinces, the probabilities of persistance for all alternatives. These groupings by physiographic province represent populations that are isolated or that could become isolated. Table 4-16 displays the results for the population on the Olympic Peninsula. This population may be isolated under all alternatives because of its distance from habitats in the Washington Cascades. Table 4-17 displays results for the population in the Washington Cascades if it is an isolated population due to the Columbia River Gorge being a barrier to dispersal. Table 4-18 is also based on the assumption that the Columbia River Gorge is a barrier to dispersal and displays results for the population in the Oregon Cascades, Coast Range, and Klamath provinces as an isolated population. Table 4-19 is based on the assumption that the Columbia River Gorge is not a barrier, and it treats the population in the Washington Cascades, Oregon Cascades, Oregon Coast Range, and Klamath provinces as a single interbreeding population. In Tables 4-18 and 4-19, the results for the Oregon Coast Range are shown separately for Alternatives A and B because, under these alternatives, the Coast Range population is predicted to become isolated from the population in the Oregon Cascades and Klamath provinces.

The decline in probability of persistence over time for virtually every population under every alternative is due to two factors. First, habitat is reduced over time because of timber harvest, and this decline in habitat will produce lower population sizes and greater risks from demographic, genetic, and catastrophic causes. Second, the probability of extinction occurring from any cause increases over time simply because the population has been exposed to risk for a longer period of time. Because the probability of extinction increases over time, probabilities of persistence at year 500 never exceed a rating of moderate and are generally either low or very low.

It will be noted that the probability of persistence at year 15 is high or very high for nearly every alternative and every population. This occurs because the spotted owl is relatively long-lived, causing a lag time in the owl's predicted response to habitat alteration. Thus, the effects of habitat alteration on owls up to year 15 may not be fully obvious until a later time. For that reason, a long-range view is needed in reviewing the results in these tables.

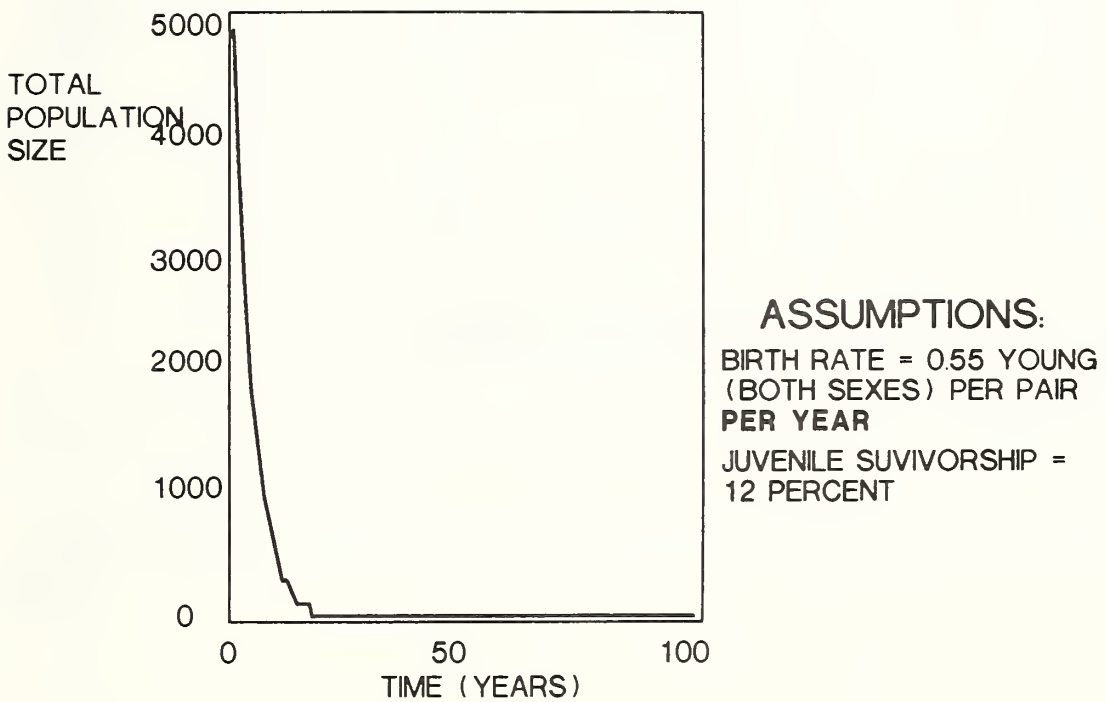


Figure 4-2. Population Projection Using Current Field Estimates of Birth and Death Rates

Table 4-16

The Projected Probability, by Alternative, of Having a Well-Distributed Population of Northern Spotted Owls on the Olympic Peninsula

See definition of probability classes in Figure 4-1

Alternative	Probability of persistence of well-distributed population by year				
	15[1/]	50	100	150	500
A	M	L	VL	VL	VL
B	M	L	VL	VL	VL
C*	H	L	VL	VL	VL
D	H	M	L	L	VL
E	H	M	L	L	VL
F**	H	M	L	L	VL
G	H	M	L	L	VL
H	H	M	M	L	VL
I	H	H	M	M	L
J	H	H	M	M	L
K	H	H	M	M	L
L	VH	H	M	M	L

*No Action alternative **Preferred alternative

[1/] Year of the Forest Plans.

Table 4-17

The Projected Probability, by Alternative, of Having a Well-distributed Population of Northern Spotted Owls in the Washington Cascades Physiographic Province

These results are based on the assumption that the Columbia River Gorge is a barrier to owl dispersal.

See definition of probability classes in Figure 4-1

Alternative	Probability of persistence of well-distributed population by year				
	15[1/]	50	100	150	500
A	M	L	VL	VL	VL
B	M	L	VL	VL	VL
C*	H	L	L	VL	VL
D	H	M	L	L	VL
E	H	M	M	L	L
F**[2/]	H	M	M-L	L	L-VL
G	H	M	M	L	L
H	H	H	M	M	L
I	H	H	M	M	L
J	H	H	M	M	L
K	H	H	H	M	L
L	VH	H	H	H	M

*No Action alternative **Preferred alternative

[1/] Year of the Forest Plans.

[2/] Some values are shown as ranges because this alternative maintains the option to provide 1000-acre or 2200-acre habitat areas after the first decade.

Table 4-18

The Projected Probability, by Alternative, of Having a Well-Distributed Population of Northern Spotted Owls in the Oregon Cascades, Klamath, and Oregon Coast Range Physiographic Provinces

These results are based on the assumption that the Columbia River Gorge is a barrier to owl dispersal

See definition of probability classes in Figure 4-1

Alternative	Probability of persistence of well-distributed population by year				
	15[1]	50	100	150	500
A	M	L[2]	VL[2]	VL[2]	VL[2]
B	M	L[2]	VL[2]	VL[2]	VL[2]
C*	H	L	L	VL	VL
D	H	M	L	L	VL
E	H	M	M	L	L
F**[3]	H	M	M-L	L	L-VL
G	H	M	M	M	L
H	H	M	M	M	L
I	H	H	M	M	L
J	VH	H	H	M	L
K	VH	H	H	M	L
L	VH	VH	H	H	M

Alternative	Coast Range			
A	L	VL	VL	VL
B	L	VL	VL	VL

*No Action alternative **Preferred alternative

[1] Year of the Forest Plans.

[2] Oregon Cascades and Klamath areas only. Coast Range becomes isolated, as shown at bottom of chart.

[3] Some values are shown as ranges because this alternative maintains the option to provide 1000-acre to 2200-acre habitat areas after the first decade.

Table 4-19

The Projected Probability, by Alternative, of Having a Well-Distributed Population of Northern Spotted Owls in the Washington Cascades, Oregon Cascades, Klamath, and Oregon Coast Range Physiographic Provinces

These results are based on the assumption that the Columbia River Gorge is not a barrier to owl dispersal

See definition of probability classes in Figure 4-1

Alternative	Probability of persistence of well-distributed population by year				
	15[1]	50	100	150	500
A	M	L[2]	VL[2]	VL[2]	VL[2]
B	M	L[2]	VL[2]	VL[2]	VL[2]
C*	H	L	L	VL	VL
D	H	M	L	L	VL
E	H	M	M	L	L
F**[3]	H	H-M	M-L	L	L-VL
G	H	H	M	M	L
H	H	H	M	M	L
I	H	H	M	M	L
J	H	H	H	M	L
K	H	H	H	M	L
L	VH	VH	H	H	M

Alternative	Coast Range			
A	L	VL	VL	VL
B	L	VL	VL	VL

*No Action alternative **Preferred alternative

[1] Year of the Forest Plans.

[2] Washington Cascades, Oregon Cascades, and Klamath areas only. Coast Range becomes isolated, as shown at bottom of chart.

[3] Some values are presented as a range because this alternative maintains the option to provide 1000-acre to 2200-acre habitat areas after the first decade.

Habitat of California subspecies and demarcation from northern subspecies

Suitable habitat exists in the Sierra Nevada roughly between 3000 and 7000 feet elevation on the west side. This band of suitable forest habitat runs north-northwest to south-southeast. The band is very narrow in places (approximately 2 to 6 miles wide), is 10-12 miles elsewhere, and is broadest at the Plumas National Forest (approximately 50 miles wide).

Laymon (1985) found that the spotted owls he radio tracked in the central Sierra Nevadas migrated downslope during winter and upslope during spring. In the low elevations, the vast majority of suitable spotted owl habitat and possible winter ranges of spotted owls occurs mostly on private land, with other areas on BLM and NFS land. The private land often occurs as semi-rural residential, and is typically laid out in parcels of 3-5 acres, which would either serve to provide for or to fragment suitable spotted owl habitat, depending on the specific development on a site.

Gould conjectured that the population of spotted owls is continuous throughout the Sierra Nevadas because the suitable habitat is continuous.

Little is known about the separation between the northern (Strix occidentalis caurina) and the California (S. o. occidentalis) subspecies. The general distribution map drawn by Grinnell and Miller (1944) showed the two subspecies as discontinuous in northern California. Their range map was based on incidental sightings and measurements of specimen owls; until the 1970's and 1980's, no comprehensive surveys for spotted owls had been made. The junction zone of the two subspecies occurs in northern California where the Sierra Nevadas meet the Klamath Physiographic Province.

The most recent and thorough information on the location of spotted owls and suitable spotted owl habitat at the junction of the two subspecies comes from Gordon Gould (California Department of Fish and Game, Sacramento; personal communication to B. Marcot, July 14-15, 1986). The junction is demarcated by the Pitt River. The southernmost extension of the northern subspecies of spotted owls seems to occur in northeastern Shasta County and southeastern Siskiyou County in northern California. Spotted owls, assumedly of the northern subspecies, have been reported in this area from the southern part of Lassen National Forest during 1982 (field surveys conducted by USDA Forest Service, on file with California Department of Fish and Game). In all, there are about 25 documented reports (dating from 1973) of spotted owls in the junction area of the two subspecies, including areas both north and south of the Pitt River. Gould had returned to several sites where spotted owls had been reported along the zone between the subspecies. He called for spotted owls at sites along the northern side of the Pitt River (northern subspecies) in both 1984 and 1985, and along the southern side (California subspecies) in 1985, and did not locate any spotted owls.

In the junction line of the two subspecies, good quality habitat is not widespread. The habitat just south of the Pitt River is only fair quality. The habitat just north of the Pitt River is variable in quality, is mostly marginal or unsuitable for spotted owls, and includes lava flows and heavily logged ponderosa pine forest.

Gould conjectured that the junction zone of the two subspecies may support only a few "core" territories of spotted owls in a large area that extends about 5 townships north to south and 10 townships east to west. Not all of these sites would be occupied at any given time, but may be colonized and occupied only during good breeding years. The junction area between the two subspecies probably acts as a strong dispersal filter that may be occupied intermittently. There appears to be a wide gap of unsuitable or marginal quality habitat across the area, and occupancy of sites by spotted owls is not constant over time. Thus, the likelihood that the California and northern subspecies of spotted owls regularly interbreed is probably low.

Flexibility in Future Decision Making

The options for spotted owl habitat that will be available ten years hence are determined by the number and size of habitat areas designated now and management actions outside those areas. The effect of current decisions on flexibility to maintain future options hinges strongly on the choice of individual habitat size, i.e., whether that size will be 300, 1000, or 2200 acres. For example, choosing Alternative C will reduce options to choose Alternatives D through L ten years hence. Accepting an alternative with 300 or 1000-acre habitat areas will probably foreclose the option to choose a 2200-acre alternative a decade from now because timber harvest during the decade will increase fragmentation and considerably reduce the opportunities to set aside 2200-acre areas ten years hence.

Within the range of the 2200-acre alternatives, the options to move to an alternative with a larger number of areas will become limited, but all options to manage for less acres per habitat area are maintained. Alternatives F through K range from 550 to 1000 habitat areas dispersed over the 13 National Forests. Choice of an alternative having 550 areas may foreclose an option to have 800 or 1000 areas in a decade since harvest will increase fragmentation and reduce opportunities for choosing additional areas. Alternative F closes options more quickly than other 2200-acre alternatives because only 1000 acres per habitat area are excluded from calculations of allowable sale quantity.

The choice of an alternative with habitat area greater than or equal to 2200 acres would maintain the option of choosing a smaller sized habitat area ten years from now if monitoring and research indicate owl viability would not be affected by these smaller units.

Ability of Spotted Owls to Adapt to Modified Habitats

Habitat occupied by spotted owls differs from the northern to the southern part of the owl's range (see Appendix C). For example, the maximum elevations at which spotted owls tend to occur increases from north to south within the species' range. In addition, the relationship between owls and old growth differs among subspecies. In the Coast Range of southern California, many pairs of the California subspecies occupy forests where few if any old-growth trees are present.

These apparent differences in the spotted owl's habitat from one geographic area to another may be related to differences in the capability of habitats to support prey species used by owls. It may be speculated that more northerly habitats support a lower density of catchable prey than do more southerly habitats. Differences in the use of habitat may also result from long-term genetic adaptation of local populations. However, this explanation must be viewed as speculative since there is no information currently available to link differences in habitat use by spotted owls to geographic differences in genetic adaptation.

The variability observed in the spotted owl's use of habitat in different geographic areas can not be taken as evidence that a specific local population or subspecies will adapt to future changes in habitat. No evidence is available to suggest that such adaptation could occur. The possibility that habitat requirements would change over time must be investigated in a properly designed, long-term monitoring program. Such evolutionary adaptations, if they did occur, would likely require the passage of a great many generations.

Timber

The effect of the various alternatives on the timber resource is directly related to the amount of habitat acres withdrawn from lands suitable for timber production. The relationship illustrated in Table 4-20, shows the amount of spotted owl habitat acres in a particular alternative which would come from lands considered suitable for timber production. Another 1.1 million acres would come from wilderness and other reserved lands in all alternatives.

Table 4-20

Spotted Owl Habitat Acres in Suitable Timber Lands

Alternative	Habitat From Suitable Timber Lands (acres)
A	0
B	24,897
C	77,343
D	313,839
E	509,779
F*	313,839-690,446
G	690,446
H	948,246
I	1,120,306
J	1,390,366
K	1,837,211
L	2,618,125

*Preferred alternative

Tables 4-21 and 4-22 illustrate the effect of each alternative on timber allowable sale quantities over the first decade of harvest stated in millions of cubic feet per year. (See Appendix H for basis of calculations.) As each alternative removes more acres from land suitable for timber production, the amount of timber volume offered also declines. The volumes in Alternatives G through L drop below the average annual quantity offered of 667.8 million cubic feet per year for the 1978 through 1984 period. The allowable sale quantity in all alternatives except Alternative A falls below the potential yield of 732 million cubic feet per year given for the same time period.

Table 4-21

Timber Volume Summary and Output Summary

13 National Forests - Example

First Decade	Alternative A	B	C	D	E	F*	G	H	I	J	K	L
MMCF/Yr	730.4	727.4	720.8	694.0	668.2	694.0	645.1	619.0	597.8	548.6	491.0	382.9
MMBF/Yr	3794	3778	3742	3604	3462	3606	3391	3219	3096	2843	2553	1971
% Volume Change from Alt. A	--	-0.4	-1.3	-5.0	-8.5	-5.0	-11.7	-15.0	-18.2	-24.9	-33.0	-47.6

Current Sell: (1975-1984) 660.9 MMCF/Yr; 3430 MMBF/Yr.
Current Cut: (1975-1984) 507.0 MMCF/Yr; 2631 MMBF/Yr.
Potential Yield: 732.0 MMCF/Yr; 3800 MMBF/Yr (from Timber Mgt. Plans, Post Wilderness Act)

*Preferred alternative

Table 4-22

First Decade Timber Volumes by Alternative by National Forest - MMCF

All Percents Indicate Change From Alternative A

National Forest	Alternative A	B	C*	D	E	F**	G	H	I	J	K	L
Deschutes	494	494	493	490	490	490	488	488	482	486	484	484
	-	0%	0%	-1%	-1%	-1%	-1%	-1%	-2%	-2%	-2%	-2%
Gifford Pinchot	932	932	924	903	887	903	858	783	814	762	705	345
	-	0%	-1%	-3%	-5%	-3%	-8%	-16%	-13%	-18%	-24%	-63%
Mt. Baker-Snoqualmie	534	528	525	488	486	486	448	380	401	407	371	267
	-	-1%	-2%	-9%	-9%	-9%	-16%	-29%	-25%	-24%	-31%	-50%
Mt. Hood	599	596	593	566	551	566	516	516	483	437	382	283
	-	-1%	-1%	-6%	-8%	-6%	-14%	-14%	-19%	-27%	-36%	-53%
Okanogan	160	160	160	159	159	159	157	153	159	159	157	154
	-	0%	0%	-1%	-1%	-1%	-2%	-4%	-1%	-1%	-2%	-4%
Olympic	610	610	606	576	571	576	534	466	471	392	338	296
	-	0%	-1%	-6%	-6%	-6%	-12%	-24%	-23%	-36%	-55%	-51%
Rogue River	336	335	329	318	304	318	288	288	263	242	210	276
	-	0%	-2%	-5%	-10%	-5%	-14%	-14%	-22%	-28%	-38%	-18%
Siskiyou	340	333	336	323	315	323	314	314	294	290	277	203
	-	-2%	-1%	-5%	-7%	-5%	-8%	-8%	-14%	-15%	-19%	-40%
Siuslaw	750	746	739	708	684	708	635	635	528	544	473	334
	-	-1%	-1%	-6%	-9%	-6%	-15%	-15%	-30%	-27%	-37%	-55%
Umpqua	731	729	719	690	623	690	638	638	592	491	413	280
	-	0%	-2%	-6%	-15%	-6%	-13%	-13%	-19%	-33%	-44%	-62%
Wenatchee	330	330	329	315	313	315	286	236	247	248	218	285
	-	0%	0%	-5%	-5%	-5%	-13%	-28%	-25%	-25%	-34%	-14%
Willamette	1180	1173	1149	1102	1010	1102	995	995	954	786	658	364
	-	-1%	-3%	-7%	-14%	-7%	-16%	-16%	-19%	-33%	-44%	-69%
Winema	309	309	305	303	288	303	295	295	269	242	221	258
	-	0%	-1%	-2%	-7%	-2%	-7%	-5%	-13%	-22%	-28%	-17%
REGIONAL TOTAL	7305	7275	7207	6941	6681	6941	6452	6187	5957	5486	4907	3829
	-	<1%	-1%	-5%	-8%	-5%	-12%	-15%	-18%	-25%	-33%	-48%

*No Action alternative **Preferred alternative

Table 4-23

Total Present Net Value and Timber Volumes for Five Decades by Alternative

Alt.	PNV Billions of Dollars	Timber Volume by Decade (MMCF) 1	2	3	4	5
A	21.7	7305	7305	7305	7305	7305
B	21.6	7275	7275	7275	7275	7275
C*	21.4	7207	7207	7207	7207	7207
D	20.6	6941	6941	6941	6941	6941
E	19.8	6681	6681	6681	6681	6681
F**	20.6	6941	6398	6398	6398	6398
G	19.1	6452	6452	6452	6452	6452
H	18.3	6187	6187	6187	6187	6187
I	17.7	5957	5957	5957	5957	5957
J	16.5	5486	5515	5515	5515	5515
K	14.6	4907	4966	4933	4493	4493
L	11.4	3829	3874	3890	3890	3962

*No Action alternative **Preferred alternative

Table 4-23 compares present net value (PNV) information and timber outputs for five decades by alternative. PNV is an economic measure of the difference between discounted benefits and discounted costs over a 150 year planning horizon for any given alternative. A 4 percent annual discount rate was assumed for this purpose. The current decision to be made is only for the ten to 15 years of the planning period. PNV information assumes the current decision will be extended in the future.

There is a strong correlation between the magnitude of PNV and the timber volumes for each alternative. As the number and size of spotted owl habitat areas increases across the range of alternatives, PNV and timber volumes both decline.

Table 4-24 illustrates the effect of increasing the number of habitat areas on individual forests. The displayed reductions in harvest and PNV are the tradeoffs or opportunity costs of providing two different levels of protection for owls. As the level of protection increases, opportunity costs increase.

Table 4-24

Average Reductions Per Habitat Area of Timber Harvest and Present Net Value by Forest for Two Alternatives.

Forest	Alternative D MMCF/SOHA (1st Dec)	Alternative D PNV/SOHA (MM$)	Alternative J MMCF/SOHA (1st Dec)	Alternative J PNV/SOHA (MM$)
Deschutes	.50	1.30	.80	1.70
Gifford Pinchot	.80	1.70	2.20	4.10
Mt. Baker Snoq	1.00	1.80	1.90	3.30
Mt. Hood	.70	1.50	1.90	4.20
Okanogan	.10	.10	.10	.10
Olympic	.80	1.30	2.90	3.80
Rogue River	.70	1.90	2.10	5.80
Siskiyou	.80	3.40	1.00	3.60
Siuslaw	1.70	4.20	4.90	14.10
Umpqua	1.10	4.40	2.50	9.85
Wenatchee	.30	.20	1.10	.90
Willamette	1.30	6.30	3.10	14.00
Winema	.80	2.00	2.10	6.10
Average	.90	2.70	2.30	6.60

Determining the significance of reductions in National Forest harvests to the region requires assessing how other ownerships might react. Undoubtedly there would be some level of response. Offsets of decreases in National Forest harvests would ameliorate the immediate negative impacts on employment. However, it is likely that those impacts would only be postponed.

Projections of future harvests in the Northwest by other owners have become increasingly pessimistic. Although precise quantities and timing are debatable, it is clear that current levels cannot be sustained beyond the next ten to 20 years. As the decrease becomes greater, increasing adjustments in the economic structure of the region will occur, as the currently defined timber industry becomes less effective as a contributor to growth or stability. The extent to which the industry can and will adapt, perhaps by producing new types of products, is now unknown. What is known is that timber supplies will constrain current kinds of activities to a greater extent in the future. Increased harvests in the next ten years to offset National Forest decreases will move the date when adjustments must be made forward. Decreases in total regional harvests would occur sooner.

If National Forest harvests were to decrease significantly, the price of stumpage would rise and other ownerships would offset some portion by increasing sales to processing mills. The quantity and duration of offsets would depend upon the size of the price increase, the availability of logs not already intended for domestic processing, and the circumstances and desires of particular owners. Any offsets would alter the magnitude and

timing of economic and employment effects of increased levels of spotted owl protection.

The TAMM analytical model was used to generate quantitative estimates of offsets at the Regional level. In the first decade, more than 60 percent of the estimated reductions under all alternatives would be offset by accelerated harvests of inventory and diversions of currently exported logs. If the National Forest reductions were continued beyond the planning period, offsets would decline as the supply of substitute logs decreased.

Table 4-25 summarizes estimated responses by other ownerships to decreases in National Forest harvests for representative alternatives. Negative numbers indicate that early-year responses would eventually lead to sharp decreases in the volumes other ownerships would make available to the domestic wood products industry. It was also estimated that stumpage prices would be about $10 per thousand board feet (MBF) higher for Alternative L in the Plan period, where net Regional supplies would be 500 million board feet (MMBF) lower than without formal owl protection. Price increases were roughly proportional to net reductions in Regional supplies.

The assumptions underlying any such projections are always debatable (Wall, 1983). For example, we are not certain how other ownerships would respond to price increases or the level of price increases that would lead to losses of markets to wood substitutes. A review of the somewhat dated inventory assumptions supporting the TAMM model suggests they overestimate the actual capability of other ownerships to increase their harvests. While the capability certainly exists in the Region, as a whole, to offset decreases associated with Alternative F, that capability may not be sufficient (particularly in the major log-losing areas) to replace the annual 700 MMBF reduction of Alternative I for the entire plan period. There are, in our judgment, only limited opportunities to replace significant National Forest harvest decreases through increased harvesting on other lands. Much of any offset from increased harvesting would be in the form of smaller trees than those preserved as spotted owl habitat. (Shifting to smaller logs for processing could impose hardships on the generally older, less efficient mills still geared to processing old-growth timber.)

The volumes of currently exported logs, if diverted to domestic processing, are sufficient to offset any of the estimated reductions from the National Forests. In 1984, about 2.2 billion board feet were exported from Washington and 0.8 billion board feet from Oregon. However, domestic log prices would have to increase substantially to overcome the current premiums paid for export logs. This is particularly unlikely in the case of western hemlock. Even if the premium for Douglas-fir were erased, the volume of export logs that might be diverted is speculative.

Table 4-25

Average Annual Changes in Harvests on the National Forests and Offsets by Other Ownerships, for Representative Alternatives, as Calculated with TAMM Model

(Millions of Board Feet)

	ALTERNATIVES		
	F	I	L
National Forest Change From Alt. A Harvest Level	-190	-700	-1800
Response by Other Ownerships			
Plan Period:	140	510	1300
Decade 2: 1/	120	40	490
Decade 3:	60	-240	-970
Decade 4:	120	-800	-1040
Decade 5:	-190	-710	-940
Net Regional Change Plan Period	- 50	-190	-500

1/ Assumes decision at end of planning period will be to continue alternative (i.e., for Alternative F the ASQ is adjusted for 1000 acres/habitat area).

In spite of these qualifications, it is reasonable to anticipate that adverse economic and employment consequences of reduced National Forest harvests would be mitigated to some extent during the planning period. To avoid clouding estimates with debatable adjustments, which would be required on an area-by-area basis, two sets of estimates are given in later discussions of economic and employment effects. Lower estimates assume offsets would compensate for one-half of estimated reductions; higher estimates assume there would be no offsets. Both estimates appear to be beyond the limits of probability.

Forest Fragmentation

The trade-off between increasing habitat availability and timber volume foregone is also influenced by forest fragmentation. As more habitat is set aside for spotted owl management, less of the suitable habitat occurs as continous blocks of unharvested timber and more as stands fragmented by past cutting practices, recent fires, or windthrow.

Forest fragmentation has an effect on integrity of all spotted owl habitat areas in all alternatives except Alternative A. This is because the Region has been harvesting timber within the Douglas-fir region aggressively since the 1950's. The influence of fragmentation becomes progressively more pronounced on spotted owl home range from Alternative B to L because more suitable habitat must be sought from an already fragmented landscape.

One of the positive indirect effects of fragmentation in any alternative is to reduce the risk of loss to conflagration since habitat will be dispersed with tracts having lower rates of spread and risks to control. As more of the owl habitat becomes fragmented, either within the habitat area or surrounding the area, the risk of winthrow increases since stands will occur in less continuous blocks. The risk to wind damage varies considerably with the local topography and the tracks of local storm cells. Generally speaking, the larger contiguous stands are more protected than stands isolated in a matrix of harvested land.

Stand Composition

The amount of habitat listed for each alternative is composed of stands dominated by mature and old-growth forest. Designating these acres as spotted owl habitat removes the mature and old-growth age classes from the silvicultural treatments normally associated with intensive forest management. Some silvicultural treatment is permitted within habitat areas but only that which is compatible with suitable habitat characteristics.

The silvicultural treatment of habitat areas is at the discretion of the National Forests. Examples of these treatments to improve owl habitat are as follows:

1. Partial removal of overstory tree canopy to encourage crown development of the tree understory.

2. Killing of certain overstory trees to induce higher quantities of standing and down dead volumes within stands.

3. Discretionary thinning of dominant, codominant, and intermediate trees to induce more rapid basal area growth (larger diameter trees) in the remaining stand.

An effect of removing a large proportion of the mature and old-growth stands from the timber production base is to redistribute the harvest to remaining stands which have either been partially harvested, or will increase the rate of harvest in mature and old-growth not designated as spotted owl habitat, or force more intensive management of immature and pole-sized stands. In all three situations the supply of timber from National Forests having northern spotted owls will decline over the next 50 years because a major source of timber volume in that period will be designated for owl habitat rather than full timber harvest. The effect is less impactful for Alternatives B, C, D, and E than the remaining alternatives. Species compostion of individual stands will not differ significantly between spotted owl alternatives.

Effect of Reducing Land Base for Timber Production

Acreage set aside for spotted owl habitat will signficantly reduce the amount of land from which timber can be harvested. More intensive silvicultural management would be necessary on the remaining acres in order to partially offset the volume foregone from land designated as owl habitat. This loss of growing potential can not be fully recovered by intensive silviculture practices as fertilization, commerical and precommercial thinning, or genetic gains on the remaining lands. Justification for such practices hinge almost exclusively on supply-demand economics of the timber industry within any given decade and the ability to sell raw material at a price that will offset the expense of management practices used to effectively increase timber supply.

A major portion of the road system has been developed on the 13 National Forests with spotted owls. The effect of designating suitable timber lands as spotted owl habitat is to reduce the amount of road miles required to access the remaining volume on lands having a developed system, and will accelerate the access to roadless areas.

Recreation

The effect on recreation of varying the number of acres being managed for northern spotted owls is to change the mix of Recreation Opportunity Spectrum (ROS) classes. Increased acres of spotted owl habitat would decrease the area available for roaded recreation and increase unroaded opportunities. More area would be available for primitive and semi-primitive experiences in Alternatives G through L than would be available for Alternatives A through F.

Roads will continue to be constructed through suitable spotted owl habitat to provide access for recreation use and timber harvest of adjacent landscapes. Roads, campgrounds, and nature trails have been located in existing owl foraging areas. Spotted owls continue to use these areas which suggest there is not an avoidance by owls of developed sites. One reason may be that spotted owls and humans use the environment at different times through the day.

The location of a nesting site, however, will significantly affect where access roads or recreation facilities should be located. The inventory of suitable habitat and location of nesting habitat is essential in coordination with recreation site development plans, road design, and cultural resource sites. Minimum construction noise and human encounters should take place in nesting habitat, or be managed so disturbance occurs after juveniles disperse.

Reserved and Roadless Areas

The characteristics of suitable spotted owl habitat are compatible with management of reserved and roadless areas, and are an integral part of these specially designated lands. However, not all reserved or roadless

areas qualify as suitable owl habitat (see Tables 3-7 and 3-8). Much of the reserved acreage within the Region is at or above the elevational limits for northern spotted owls and in timber types not preferred by owls.

On some National Forests a considerable proportion of roadless acreage (Table 3-7) is suitable northern spotted owl habitat. During the viability analysis, the amount of land designated as owl habitat within the reserved and not technically suited for timber production catagory remained constant at 229 habitat areas or 1.1 million acres across all alternatives. In practice, the number of spotted owl habitat areas given in each alternative, and the acreage these areas represent, may directly affect the harvest of roadless areas. This is due to a direct relationship between acres available for timber production under a given alternative and the timber sale volume for that alternative.

The rate of harvest from roadless areas would be much less in Alternatives B and C than Alternatives D through L, since these later alternatives designate considerable owl habitat outside reserved areas. As the size and number of habitat areas increases across alternatives, more lands tentatively suitable for timber harvest will be unavailable within the next plan period and more urgency placed on recovering these timber volumes from roadless areas. This trend will accentuate as lands become more fragmented from past harvest scheduling. Alternative F will result in an entry rate into the roadless areas which is comparable to or slightly accelerated over Alternative I.

The Wilderness Act directs that wilderness (one kind of reserved area) be managed primarily as natural ecosystems. Fire management policy for wilderness is directed toward allowing fires to play their natural ecological role within wilderness. As a result of this policy, habitat areas found in wilderness may not offer the same degree of protection from fire as those areas located in unreserved lands. Alternatives A, B, and C,which strongly depend on the distribution of suitable habitat within and adjacent to reserved areas, will be most sensitive to fires within wildernesss and could, in turn, effect the use of fire as a tool in the management of the wilderness environment.

Configurations of timber harvest units which lie adjacent to wilderness and roadless areas also affect the integrity of designated spotted owl habitat by influencing wind flow patterns, fire intensity, and resistence to control parameters.

Visual Resources

Visual quality may be enhanced where spotted owl habitats are located in intensively managed landscapes, such as in areas that have a modification or maximum modification visual quality objective, resulting in a retention or partial retention appearance. Within reserved areas, such as wilderness, spotted owl habitat would always be associated with the preservation visual quality objective. Areas that are being managed for retention or partial retention will be used to locate a portion of the spotted owl habitats, thus reducing impacts of visual quality objectives on

timber production levels. The identification of habitat areas and nesting sites during the monitoring period is necessary to coordinate visual management strategies with the integrity of suitable habitat.

Cultural Resources

Resource management activities, including stand harvest, ground scarification , and road construction, have the potential to affect cultural and historical resources. These activities also provide the greatest opportunity for discovering new sites. All ground disturbing activities will be preceded by a cultural resource inventory. Any timber harvest procedure which is used to develop structural characteristics of northern spotted owl habitat will include such an inventory, and significant cultural resource values will be protected.

Management for spotted owl habitat increases the opportunities for undisturbed preservation in place of inventoried cultural resources. This treatment affords the best protection for all of a property's significant values. There may be fewer opportunities, however, to identify previously undiscovered sites where retention of natural environmental quality is a management objective. When undiscovered resources receive passive protection, they are also subject to loss from natural processes or from human impact without prior record.

Watershed and Soils

Watersheds and soils are generally protected by Minimum Management Requirements (MMR) associated with direction given in the Pacific Northwest Regional Guide. For example, sedimentation in streams will probably differ little between alternatives because the MMR's provide for protection of riparian areas in any alternative. All effects of spotted owl management on watershed and soil values are indirect.

In addition to the MMR's, some protection from soil compaction, displacement, or non-point pollution is provided by suitable spotted owl habitat as the size and number of areas of this habitat increase across alternatives.

This situation would occur much more commonly in Alternatives F through L which have a large portion of suitable owl habitat located in lands also tenatively suitable for timber production, than in Alternatives A and B where habitat mainly comes from reserved lands. Habitat areas will provide additional protection in riparian areas by extending the 100-foot management guide used to buffer streams from adjacent timber harvest units. Occasionally suitable owl habitat can be located in municipal watersheds as in the Bull Run, Ashland, and Cedar River, for example.

Rangeland

The definition of suitable owl habitat as imbedded in the alternatives precludes a consideration of rangelands. Northern spotted owl habitat is usually considered nonrange for livestock. No effect is foreseen.

Mineral and Rock Resources

The effect of the various alternatives on the mineral resource is directly related to the acres that may be withdrawn from mineral entry. Refer to Table 4-1 for an estimate of the potential impact of mineral withdrawal by alternative.

Threatened and Endangered Species, Critical Habitat

Suitable spotted owl habitat is also preferred habitat for several other species (see Table 3-9). Of the 200 wildlife species known to use this habitat, only the bald eagle has been placed on the Federal Threatened and Endangered Species list. Alternatives which provide large acreages of mature and old-growth habitat will partially meet the habitat needs of the bald eagle in that portion of the eagle's range which coincides with spotted owl. The spotted owl requires a much larger habitat to be reserved. Provision for bald eagle habitat is one of the MMR's associated with current direction even when northern spotted owl habitat has not been designated. Eagle roost sites receive protection under Forest Plans and in timber sale action plans. Bald eagles are also managed according to direction given in recovery plans.

The same mature and old-growth stands considered suitable spotted owl habitat also support several animal species that are solely dependent on an environment that is laced with snags, downed logs, decaying stumps, thick humus layers, and multi-layered tree canopies. Spotted owl habitat designated under the preferred alternative will provide more area for these other species than normally would occur under current direction.

There are no threatened or endangered plant species which are solely dependent on mature or old-growth forest stands.

OTHER ENVIRONMENTAL EFFECTS

Wetlands, Floodplains, Wild and Scenic Rivers, Special Land Designations

Generally speaking, as the amount of habitat set aside for northern spotted owl increases across the various alternatives there will be increases in protection of riparian areas associated with owl habitat. Floodplains, prime farmlands, and wetlands located within these watersheds will receive additional protection beyond that associated with MMR's under Alternative A.

Spotted owl habitat may be located within lands protected by wild and scenic river designation. Under the wild and scenic river, status timber harvest will not occur within the site of the river. The reservation of spotted owl habitat is compatible with the management of wild and scenic rivers. Human activity, both from an administrative and recreational standpoint, is largely confined to the river system itself and at a time of the day when owls are less active.

Special land designations for scenic, geological, historical, or research natural area purposes provide an opportunity to combine several resource concerns within the same area. As with recreation, the main conflict is human activity during the period when juvenile owls are fledging and dispersing. Discretionary location of roads and trails will minimize this interference. Often the structural characteristics of plant communities reserved by a research natural area fit well into the definition of suitable owl habitat.

Energy Requirements

Dedication of northern spotted owl habitats require much less energy than active management of these same lands. The main energy outlays during the ten to 15 year plan period will be in monitoring of habitat use (see Appendix D). Monitoring levels remain fairly constant across alternatives due to present levels of scientific uncertainty regarding owl biology. Energy use for monitoring will be considerably less than the same outputs required under intensive timber harvest, or that level experienced under Alternative A.

Irreversible and Irretrievable Commitment of Resources from Implementation of an Alternative

Implementation of any particular alternative will result in a loss of some harvestable timber volume in the long term. For example, under the preferred alternative (Alternative F) 1000 acres of suitable timber land per spotted owl habitat area would be withheld from harvest scheduling for the plan period. The remaining 1200 acres in the habitat area will not be harvested but will be used in the calculation of an allowable sale quantity. The loss of volume will occur from (1) reductions of growth on stands withheld from harvest, (2) current losses from windthrow, (3) losses attributed to insects and disease as incipent, non-catastrophic factors, and (4) losses attributed to wildfires where high fuel loads and inaccessibility increase resistance to control.

Windthrow and wildfire are direct factors having immediate impact on volume production. More indirect are losses from decreased growth, disease, and insects which affect volumes currently cut against or extensions for future years. This is an irretrievable effect in that timber volume is lost from future inventories. The volume foregone is less under Alternatives A, B, C, D and E and much more under Alternatives G through L.

An irreversible effect results if monitoring and research during the plan period indicate spotted owls require more than the habitat area designated under the selected alternative. This would require the designation of capable owl habitat to be grown into the suitable category. In order to ameliorate risks of reducing owl viability, additional suitable habitat may need to be withdrawn from lands suitable for timber production. The effect is much less in Alternatives as H, I, K, and L which provide a considerable number of large-sized habitat areas.

Unavoidable Adverse Environmental Effects from Implementation of an Alternative.

Implementation of any particular alternative will result in the continued harvesting of suitable spotted owl habitat on lands suitable for timber production. For example, under the preferred alternative (Alternative F) this will result in a change in suitable owl habitat on lands administered by the Forest Service from 3.6 million acres at present to 1.9 million acres 50 years from now. This reduction of potentially suitable owl habitat would be more in Alternatives A through E which require smaller sizes for an individual habitat area.

As the lands suitable for owl habitat are harvested, the habitat of a breeding pair will become more and more fragmented and the home range will become larger. In other words, the stands of mature and old-growth timber will become smaller and widely scattered. Experience has shown that at some point during this fragmentation, the spotted owls leave the area. In 50 years one could expect the owl population to be residing primarily in the mature and old-growth timber remaining in spotted owl habitat areas.

The possibility exists that in several generations the species may adapt to these fragmented landscapes. These owls will occur on lands both suitable and not suitable for timber production including such lands on other ownerships. Monitoring and research is proposed during the first plan period (see Appendix D) which will evaluate the effects of fragmentation and provide the basis for developing harvest strategies that would minimize this fragmentation effect on spotted owl habitat.

For resources such as water quality and soil, the impacts associated with timber management activities will occur on those areas harvested. The number of old-growth dependent species will decline as suitable owl habitat is reduced in the Region from 3.6 million acres down to 1.9 million acres under the preferred alternative (Alternative F). Other species as the barred owl, red-tailed hawk, red fox, and badger would be expected to increase as forest management changes more area to early successional forest types. Only in Alternatives K and L is suitable habitat provided at current levels with little or no falldown from habitat inventoried in the mid-1980's.

Incomplete or Unavailable Information

The Council on Environmental Quality's National Environmental Policy Act Regulations relating to incomplete or unavailable information have been recently amended (40 CFR 1502.22, amended at 51 Fed. Reg. 15618 (April 25, 1986)). For environmental impact statements in progress, the amended regulation gives agencies a choice of complying with either the original or amended requirements. The discussion below is designed to meet the requirements of the amended regulations.

In preparing this Supplement to the Pacific Northwest Regional Guide, we have determined that:

1. The discussions of the management of northern spotted owl habitat in this Supplement have involved an evaluation of reasonably foreseeable significant adverse effects on the human environment,

2. The evaluation of those impacts has been based upon an information base that is incomplete or unavailable, and

3. The incomplete or unavailable information cannot be obtained because the overall time and money costs to obtain the information are exorbitant, and in some cases the means to obtain the information are not known. (See additional discussion in the section below.)

Consequently, pursuant to 40 CFR 1502.22(b), as amended, the following discussion describes this incomplete or unavailable information and why it was not obtained; indicates the relevance of this information to evaluating reasonably foreseeable significant adverse impacts on the human environment; indicates where in the Appendix a summary can be found of the existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and references the evaluation in Chapter 4 of such impacts based upon theoretical approaches and research methods generally accepted in the scientific community.

Description of the Incomplete or Unavailable Information

The following attributes of the northern spotted owl and its habitat have not been adequately determined:

1. The size and age-structure of existing populations

2. Long-term averages and variations in age-specific birth and survival rates

3. Mean and variation of distances traveled by successfully dispersing juvenile owls

4. Site characteristics that contribute to habitat quality for spotted owls

5. The relationship between habitat quality and the amount of habitat used by pairs of owls

6. Variations in habitat requirements across the range of the northern spotted owl

7. Frequency and intensity of catastrophic losses of habitat

8. The ability of owls to traverse potential barriers at the Columbia River Gorge, the Puget Trough, and the southern Oregon Coast Range

9. The competitive relationships between spotted and barred owls

In addition, there is no data base available on the spotted owl or any other existing species that empirically relates specific population sizes to specific risks of extinction.

There are several reasons why there is lack of a complete data base for these attributes. First, the known techniques for estimating the attributes are expensive and time-consuming, and it is therefore difficult to obtain a large enough sample size to insure that the attributes are accurately measured. For example, the most efficient technique for determining dispersal distances of juveniles is radiotelemetry. This involves capturing juvenile owls, outfitting them with radio harnesses, and then following them for a period of at least a full year. In studies to date, 80 percent of the juveniles that have been tracked have died or disappeared before successfully settling in a new habitat area, so the sample size of successfully dispersing juveniles is quite limited.

Second, providing an adequate data base for many of these attributes requires sampling over very long time periods, possibly up to several decades. For example, age-specific birth rates must be sampled over a long enough period to account for the irregular breeding pattern of the spotted owl. Since the factors that control this breeding pattern are not currently known, it is not possible to determine how many years of breeding data are needed for an adequate estimate of a long-term average birth rate.

Finally, techniques for assessment of some of these factors are unknown. For example, there are no known techniques for establishing an empirical relationship between population size and risk of extinction. Since this data is not obtainable, the relationship must be derived theoretically.

Given the situation discussed above, it was decided that the time required to complete the studies and the money costs to obtain the incomplete or unavailable information were exorbitant. In some areas, such as juvenile survival, it is not clear that means are available to determine the needed information. Therefore the development of this Supplement to address the management needs to maintain the viability of the northern spotted owl has proceeded despite the incomplete or unavailable information.

Relevance of the Incomplete or Unavailable Information to Evaluating Impacts

The purpose of this Supplement is to determine the management direction needed to maintain viable populations of the northern spotted owl. The areas of incomplete or unavailable information identified below are relevant to the evaluation of adverse impacts associated with the alternatives for the management of northern spotted owls,because the information involved is used in determining the viability of the northern spotted owl. These areas include:

1. The actual size of the population that can be supported by specific types and amounts of habitats

2. The likely loss of habitat to catastrophic events up to specified times in the future

3. The likelihood that a given distribution of habitat areas will allow successful recolonization of areas that become vacated over time

4. The likelihood that the owl population will split into several smaller populations that no longer interbreed

5. The possibility of mitigating genetic and demographic risks of isolated populations by transferring individuals or eggs between populations.

6. The proportion of habitat areas that will be occupied by barred owls rather then spotted owls

7. The likelihood that the species can survive random or cyclic periods of low reproductive success

Summary of Existing Relevant Scientific Evidence

A summary of relevant scientific information on the spotted owl is presented in Appendix C, and some of this information is further updated in Appendix B. A synopsis of those research findings follows.

Three subspecies of the spotted owl are currently recognized: the northern spotted owl (Strix occidentalis caurina), the California spotted owl (S. occidentalis occidentalis), and the Mexican spotted owl (S. occidentalis lucida). The northern spotted owl is confined to southwestern British Columbia, the coastal mountains and Cascade Range of Oregon and Washington, and the Klamath Mountain Province, which includes southwestern Oregon and the Coast Range of northwestern California, north of San Francisco.

The California Department of Fish and Game has classified the spotted owl as a "species of special concern." The Oregon Department of Fish and Wildlife and the Washington Department of Game each list the spotted owl as a threatened species. None of the races or populations of the spotted owl is on the Federal list of threatened or endangered species.

In California, spotted owls have been located at 772 sites within the range of the northern subspecies (Gould, 1974; 1975; 1977; 1979; and 1985). In Oregon, spotted owls have been located at 1500 sites (Forsman, Oregon Department of Fish and Wildlife; unpublished data), and in Washington they have been reported on approximately 300 sites. (Refer to Appendix C.) However, the fraction of all such sites that currently contain breeding pairs is unknown.

Old-growth forests or mixed stands of mature and old-growth forests dominated 98 percent of the sites where owls were located in Oregon between 1969 and 1980 (Forsman and others, 1984). Preference for older forests was also indicated by a study in Oregon in which spotted owls were encountered 12 times more frequently in old-growth forests than in young second-growth forests (Forsman and others, 1977). Habitat preference appears to be similar in Washington (Postovit, 1977; Garcia, 1979) and northwestern California (Gould, 1974; Marcot, 1979; Marcot and Gardetto, 1980; Solis, 1984; Sisco and Gutierrez, 1984).

In a radiotelemetry study in the Oregon Cascades and Oregon Coast Range, annual home ranges of six pairs of spotted owls averaged 6614 acres (Forsman, 1980 and 1981a; Forsman and others, 1984). The mean amount of old-growth within the pair home ranges was 2264 acres. In north central Washington, the annual home ranges of three pairs averaged 8585 acres and the amount of old-growth within these areas averaged 4202 acres (Allen and Brewer, 1985).

Reproduction by spotted owls fluctuates from year to year. The average reproductive rate observed to date is 0.55 young per pair per year (Laymon and Barrett, 1985; Gutierrez and others, 1985; Barrows, 1985; Forsman and others, 1984; Meslow, 1984). The usual number of eggs laid by females is two (Forsman and others, 1984). The average observed mortality rate of juveniles after leaving their nests but prior to dispersal is 40 percent (Forsman and others, 1984; Laymon, 1985; Meslow, 1985; Gutierrez and others, 1985; Gutierrez, 1985). Observed mortality of juveniles during dispersal is 80 percent (Gutierrez and others, 1985; Forsman and others, 1984; Miller and Meslow, 1985). In three studies of juvenile dispersal distance (Forsman, 1980; Gutierrez and others, 1985; Meslow, 1984), the straight-line distance from the natal area to the farthest radio point observed averaged 27 miles. The range of observed distances was from three miles to 62 miles.

Little quantitative information is available on adult survival rate or longevity, but Barrowclough and Coats (1985) have estimated the annual adult survival rate at 0.85. The life span of owls in the wild is not known, but Barrowclough and Coats (1985) used an estimate of ten years.

Spotted owls feed on a variety of mammals, birds, reptiles, and insects. The exact composition of the diet varies by region and season. In northwestern Oregon, the northern flying squirrel was found to be the most frequent prey species (Forsman and others, 1984). In southwestern Oregon, woodrats and northern flying squirrels were, respectively, most frequent and second most frequent prey species. The diet of owls in northwestern California is similar to the diet in southwestern Oregon (Barrows, 1978 and 1985; Solis, 1983).

Predation by great horned owls of spotted owls has been documented in Oregon (Forsman and others, 1984). Other potential predators on spotted owls include ravens, goshawks, Cooper's hawks, and red-tailed hawks (Forsman and others, 1984). The invasion of the barred owl into the range of the spotted owl may represent a significant competitive threat to the spotted owl (Taylor and Forsman, 1976; U.S. Fish and Wildlife Service, 1982; Gutierrez and others, 1984; Allen and others, 1985).

Evaluation of Reasonably Foreseeable Significant Adverse Impacts

The evaluation of impacts on viability of the spotted owl population is presented in Chapter 4, and the techniques used to perform this evaluation are detailed in Appendix B. The techniques employed followed theoretical approaches that are founded on currently accepted ecological concepts. Where possible, existing analysis techniques were used. Examples of such existing techniques were the life-table analysis used to assess rates of change in owl populations; the linear programming models used to estimate rates of harvest of habitat; and the calculations used to determine inbreeding coefficients. In some cases, new analytical techniques were devised because no existing techniques were available. An example is the simulation model used to investigate the effect of habitat distribution on habitat occupancy. Where new analysis techniques were employed, they were based on existing and generally accepted theoretical approaches.

Since the approach used to determine viability had to be theoretical rather than empirical, we used a variety of analytical techniques and simulation systems to help predict future population responses. Uncertainty surrounded each of these techniques, so they were treated as independent indicators of population responses and then compared to each other in the final assessment. In this way, we were able to see if each theoretical approach would reinforce or contradict the others. Where different models gave different predictions, an attempt was made to see which input values or underlying assumptions produced the differing results. This assessment provided a sounder understanding of both the factors that limit owl viability and the limitations of each of the theoretical approaches.

Finally, where vital information was missing or inadequate, sensitivity analysis was used to assess the importance of that information. Sensitivity analysis is used to assess the relative importance of different factors in determining the viability of the owl populations. An example of sensitivity testing was the analysis of viability using two different assumptions about the ability of owls to disperse across the Columbia River Gorge.

Relationship Between Short Term Uses and Long-term Productivity

The short term uses of man's environment (timber production, recreation, road access) and the enhancement of long-term productivity are closely related in the case of providing habitat for northern spotted owls. Designating certain stands of mature and old-growth timber, as proposed spotted owl habitat, considerably extends the rotation age of these

stands. Stand productivity is maintained by minimizing activities which remove the tree layer, displace the soil, consume the nutrient-rich detritus component.

Spotted owl habitats are characterized by nutrient turnover and soil erosion rates typical of natural, unmanaged environments that can serve to buffer watersheds which are being intensively managed for timber production under an even-aged concept on 80 to 120 year rotations. Spotted owl habitat areas provide the rest and recovery opportunity of an intensively managed landscape in which segments of the landscape are in various stages of successional development. Alternatives which provide for large habitat areas, as 2200, 4200, and 6600 acres, provide a greater opportunity to maintain a more favorable mix of disturbed and undisturbed environments through time than those alternatives whose habitat is restricted to reserved lands or 300 to 1000 acre areas.

MITIGATION MEASURES COMMON TO ALL ALTERNATIVES

Artifical Introduction of Spotted Owls, Reasons and Necessary Information

Artificial introduction is the moving of animals into areas that they would not have normally inhabited or invaded. Artificial introduction is a potential mitigating measure. This section discusses the pros, cons, and uncertainties of moving animals. Monitoring and Research will provide information on methods for artificial introduction, see Appendix D.

Generally, moving owls is done for one of three reasons:

1. To begin a population in an area that has none.

2. To benefit the genetic conditions of an existing population.

3. To replace owls that have died in an existing population that is declining.

Moving owls to begin a population requires that there be a donor population available. In moving animals, the number, ages, and sex ratio of the introduced owls may be controlled. This is beneficial in beginning a population because the correct combinations of numbers, ages, and sex ratio may be selected to maximize the reproductive rate of the new population in order to help ensure success. To determine if the newly founded population is a success, most or all of the introduced owls are monitored for their breeding status and reproductive rate. The costs of such a monitoring program would be comparable to the costs of the demographic monitoring efforts presented elsewhere in this document (see Appendix D, Table D-2).

The causes for extinction of the original population may also affect the new, introduced population. Such causes may include competition for nesting or feeding habitat with the barred owl; predation by great horned owls or other predators; habitat being too widely spaced for successful dispersal; and overall loss of habitat. A newly introduced population could not be expected to overcome these problems.

Additionally, a new population may have to be introduced a number of times before the operation is successful. Such repeated introductions have been found to be necessary with wild turkeys, ruffed grouse, greater prairie chickens, and many birds of prey. This adds substantially to the costs.

Owls may be moved to benefit genetic conditions. Introductions may be helpful in keeping a particular population genetically healthy. Genetic health is measured by how many genetically different individuals are in a given population. When a population is small and isolated from other populations, genetic health deteriorates through inbreeding and through the random deaths of genetically different individuals. Introducing owls from an outside population could help avoid local extinction.

A general rule of thumb is that, to maintain a genetically healthy population, only about 1 percent of the size of a population would have to consist of animals from outside the population each generation (Frankel, 1983). However, this 1 percent assumes that all adult animals breed randomly with each other and that the population is moderately large. These conditions are not met with spotted owl populations.

This means that the proportion of the population that must be mixed with outside individuals might be more on the order of 20 percent per generation, and perhaps higher, rather than 1 percent (Frankel, 1983). For example, if an isolated spotted owl population consisted of 50 pairs (100 breeding individuals), then between one and 20 owls, perhaps more, would have to be introduced each generation. A generation of spotted owls is about five years. This would have to be repeated for each generation and for each population that is isolated and that may potentially experience problems with genetic health.

Successful introduction requires verifying that the introduced owls do, indeed, breed within the population and that their young survive to pass on their genes. This may entail a substantial monitoring effort to locate and follow the introduced owls and their young. One could not simply assume successful pairing, reproduction, dispersal of young, and reproductive success of the offspring without evidence from such a monitoring program.

Also, there is some scientific uncertainty about the advantages of artificially maintaining the genetic health of a population in this manner. The result of introducing owls to maintain the genetic health of a population is to increase the size of the population that is interbreeding. However, this may reduce the local adaptation of the population by introducing genetic material from populations that derive from different environmental conditions. The degree to which this would be a detriment is unknown.

The final reason to introduce owls is to replace owls in a declining population. The general idea is to prevent small, isolated populations from going extinct through chance high death rates and low birth rates. In this case, introductions would be done to maintain the total number of owls in a population rather than to maintain a mix of genetically different individuals in a population.

Several information requirements follow from this strategy. The first is that it would be difficult to tell exactly when a population was experiencing a decline and would require the addition of owls. Spotted owl populations are very difficult to count, and population trends are difficult to determine without the extensive counting of animals in each age class and sampling for reproductive rate of the population.

A second information requirement is the number of owls that would have to be introduced during any given year or generation. The 1-percent and 20-percent rules of thumb discussed above pertain only to maintaining the genetic health of a population. To maintain total population size, substantially more owls may have to be introduced on a more or less regular basis. The number of owls to be introduced would vary according to the population size, the rate of decline of the population, and the number of habitat areas that are unoccupied at any given time. The number of introduced owls required may range from the tens to the hundreds over a few years.

A third information requirement is deciding on the appropriate ages, sex ratio, and numbers of owls to introduce to increase the chances of success. Also, which season is best for such introductions and for how many consecutive years such introductions are to be made should be determined.

Source Populations

The existence of a source of owls is an important condition for successful introductions. One approach is to capture and transport owls from other, larger populations that are not experiencing problems with genetic health or any other factors that could cause local population declines. However, this donor population should be monitored for problems caused by the removal of a significant number of owls.

The concerns of affecting a donor population may be mitigated by establishing a captive breeding population of spotted owls or using pens (aviaries) to hold owls to be introduced elsewhere. Little is understood of breeding owls under such conditions, and few attempts have been made to breed spotted owls in captivity. The Patuxent center has raised owls in pens. Based on their experience, the costs of artificially breeding spotted owls in numbers high enough to offset both genetic and demographic problems would be substantial. An initial estimate is $200,000 for set-up and $50,000 to $70,000 per year for maintenance and feeding. These costs do not include additional costs of initially capturing and subsequently transporting owls. This set-up would likely provide for a few dozen owls to be introduced every year or two. Larger pens with higher maintenance costs would be needed to provide a greater number of owls.

SOCIAL AND ECONOMIC EFFECTS

Regional effects are discussed in Chapter 2. Here, the focus is on effects at state and sub-state levels. (See Appendix H for a discussion of technical procedures and assumptions.)

The effects on employment differ in the two states (Table 4-26). About one-third of the job losses in most alternatives would occur in Washington and two-thirds in Oregon. These calculations are based on the estimate that six jobs in the logging and wood processing industry and one Forest Service job would be lost, on average, for each decrease of one million board feet (MMBF) in National Forest harvests, if there were no increase in logs for domestic processing from other sources. If there were offsetting increases, the effects would be proportionately less.

In addition, "nondirect" jobs dependent upon the forest products industry -- machinery suppliers, banks, grocery stores -- would also be affected. Less reliable estimates of these "multiplier effects" can be obtained by multiplying the direct jobs displayed for Washington and Oregon by 2.71 and 2.59, respectively.

Job losses and other impacts would not be felt equally by all communities within the states. In addition to the individual hardships that accompany lay-offs, the economic foundations of some areas could be threatened.

The forest products industry plays a key role in the growth and development of the Region and of many local communities. It brings in "new" dollars by selling products outside the Region or community. These are the dollars that support services to residents through grocery stores, barber shops, realty firms, schools, and local governments. When sales to outsiders largely consist of processed timber products, any reduction in supplies of logs for processing can significantly reduce these flows of money. Immediate consequences would be reduced profits and job layoffs in the wood products industry, followed by decreased income to local businesses and institutions and more job layoffs. Widespread "nondirect" or "multiplier" effects would be triggered by problems encountered by the wood products industry and other firms that make up the "economic base" of a community.

The second column in Table 4-27 shows the relative importance of the forest products industry as the source of outside dollars for particular areas, called "impact areas," of the Region. (See Appendix H for definitions.) The importance of reductions in log flows for processing to the economic viability of these areas is proportional to these indices. A larger index means reductions would be more significant. Western Washington and Oregon, except for the areas dominated by Seattle-Tacoma and Portland, are heavily dependent for their economic well-being on the forest products industry. But to assess the effects of spotted owl protection also requires knowing the portion of logs that come from the National Forests. These are shown in the third column of the table.

Table 4-26

Average Annual Reductions in National Forest Harvests and in Resulting Direct Private and Forest Service Employment During the Plan Period, by State and Region 1/

ALT.	Washington Harvest (MMBF)	Washington Jobs	Oregon Harvest (MMBF)	Oregon Jobs	Region Harvest (MMBF)	Region Jobs
B 2/	3.1	5	12.4	10	15.5	15
C 2/	11.5	15	39.4	35	50.9	50
D & F*	65.9	260 - 460	124.0	500 - 870	189.9	760 - 1330
E	77.8	330 - 560	246.1	960 - 1700	323.9	1290 - 2260
G	146.8	580 - 1020	295.9	1190 - 2080	442.7	1770 - 3100
H	284.3	1130 - 1980	295.9	1190 - 2080	580.2	2320 - 4060
I	245.9	960 - 1700	453.6	1840 - 3200	699.5	2800 - 4900
J	310.3	1230 - 2160	633.9	2540 - 4440	944.2	3770 - 6600
K	403.3	1610 - 2820	841.3	3365 - 5890	1244.6	4975 - 8710
L	632.8	2480 - 4380	1171.4	4735 - 8250	1804.2	7215 - 12630

* Preferred alternative

1/ Low estimate assumes 50 percent of National Forest harvest reduction would be offset by other ownerships; high estimate assumes no offset. 1984 employment in the wood products industry was about 30,300 jobs in Washington and 52,200 in Oregon.

2/ Relatively low volume reductions probably would not lead to reductions in private sector employment.

The importance to the domestic wood processing industry of harvests from the National Forests varies from 14 percent of the total harvest in the Olympic Peninsula area to 65 percent in the central Oregon area. Figure 4-3, which shows the relationship of timber dependency to the importance of logs from the National Forests, illustrates the complexity of evaluating the local economic impacts of National Forest harvest reductions. For example, reductions would probably have a more profound and long-lasting effect on the economic vitality of communities in southwest Washington than in central Washington, even though a larger proportion of logs for processing come from the National Forests. The lower timber dependency index for central Washington indicates its economy is less timber-dependent or more diversified. This means there will be relatively more opportunities outside the timber industry for displaced workers to seek re-employment. The current unemployment rates for the total work forces in the impact areas in Table 4-27, however, suggest this long-run expectation may not be true at the moment: 1-of-8 total workers are now unemployed in central Washington. The net effects in the Northwest of National Forest harvest reductions depend on much more than conditions in the wood products industry.

Table 4-27

The Relative Importance of the Forest Products Industry and National Forest Log Flows to the Economic Vitality of Impact Areas[1/]

Impact Area	Timber Dependency Index	Proportion NF Logs	Economic Impact Indicator[2/]	Total Unemployment Rate
WASHINGTON:				
Puget Sound	6	21%	126	7.0%
Olympic Penniusula	41	14%	580	10.1%
Southwest Washington	59	21%	1229	9.8%
Central Washington	6	48%	310	12.5%
OREGON:				
Northwest Oregon	10	29%	292	7.7%
West Central Oregon	46	39%	1780	9.1%
Southwest Oregon	59	25%	1495	10.8%
Central Oregon	48	65%	3128	11.6%

[1/] See Appendix H, for definitions and procedures. The Inland Empire impact area in Washington and the Blue Mountain impact area in Oregon would not be affected significantly by spotted owl alternatives.

[2/] Relative indices calculated as the products of the first two columns.

"Economic impact indicators" of the relative importance of National Forest harvest reductions to the outside-earning power of the impact areas are also defined in Table 4-27. In Figure 4-4, these indicators are compared to the reductions in logs flowing from the National Forests to the impact areas for processing under three alternatives -- F, I and L -- that include the range of potential reductions. The potential negative impacts on area stability increase as the "distance" of impact areas from the origin of the figure increases.

The economic consequences of harvest reductions would be relatively modest for the overall vitality of many areas, even though individual displaced workers might face considerable hardship. Most of the relatively low-impact areas, falling in the low-impact zone of Figure 4-4, are located in Washington.

The most critical situations, in the high-impact zone, involve communities located in west central and southwest Oregon. Here, even relatively modest reductions in National Forest log flows could precipitate community-wide economic problems. Merchants, as well as workers employed in the forest products industry, could find it difficult to adjust to a decline in timber processing. Even moving out of the area to find employment elsewhere could be difficult. Individuals might, for example, find it difficult to sell their businesses and homes -- other people might also want to leave or be unable to buy them. Consequently, harvest reductions could be costly in terms of both human welfare and industrial capital.

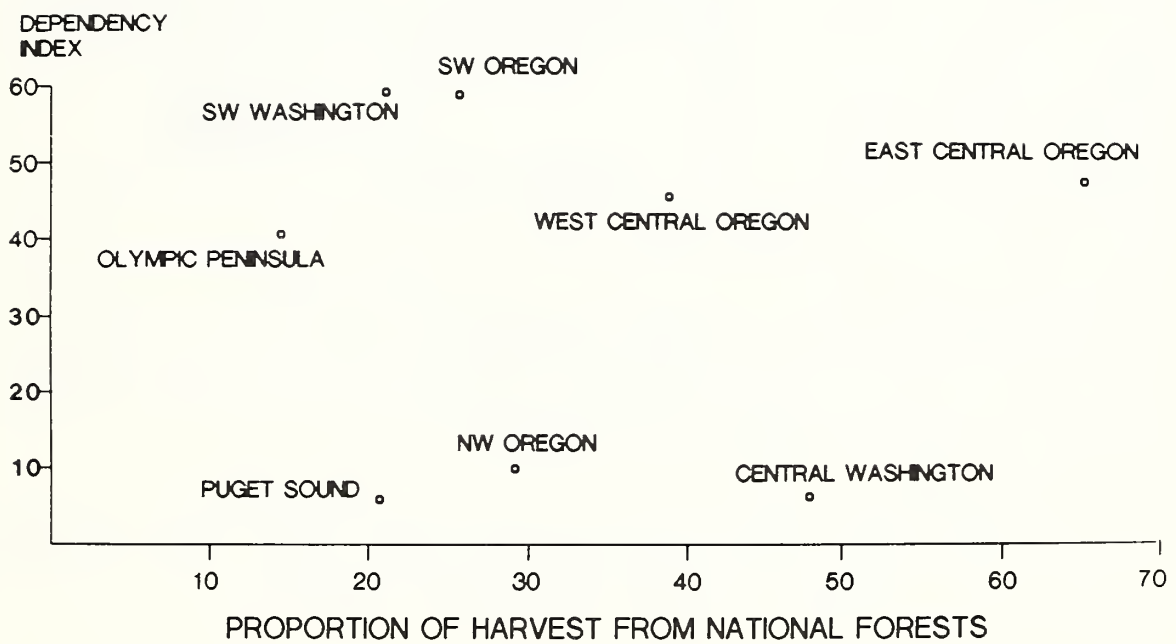


Figure 4-3. Timber Dependency and the Importance of National Forest Logs.

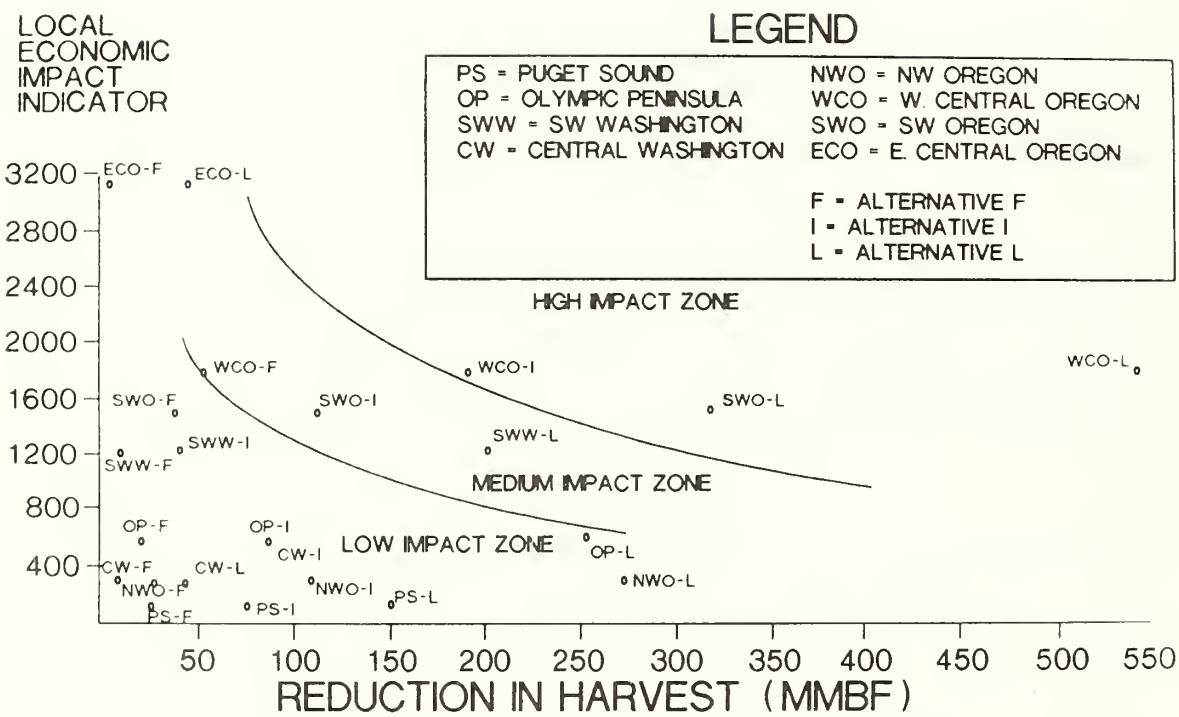


Figure 4-4. Importance of the Spotted Owl Protection Decision to the Economic Vitality of Impact Areas Under Representative Alternatives.

In addition to reductions in log flows from the National Forests, wood processing areas would suffer reductions in cash payments that are based on 25 percent of National Forest gross receipts. In this region, receipts from timber sales and expenditures by purchasers to develop access to that timber account for nearly all such payments. Reductions in payments are summarized at the state and Regional levels in Table 4-28. They are further disaggregated to individual impact areas, under the three representative alternatives, in Table 4-29. Again, impacts in terms of reductions in dollar payments would fall most heavily on western Oregon.

Table 4-28

Average Annual Reductions in Payments to Counties[1/] During the Planning Period by State and Region

Alternative	Washington		Oregon		Region	
	MM$	% Alt A.	MM$	% Alt A	MM$	% Alt A
B	0.1	0	0.6	1	0.7	0
C	0.5	1	2.0	2	2.5	1
D & F*	2.7	5	6.1	5	8.8	5
E	3.2	6	12.2	10	15.4	9
G	5.9	11	14.7	12	20.6	12
H	11.3	21	14.7	12	26.0	15
I	9.7	18	22.4	19	32.1	19
J	12.1	23	31.4	26	43.5	25
K	15.8	30	41.7	35	57.5	33
L	27.1	51	58.6	49	85.7	50

* Preferred Alternative

[1/] Counties in California also receive payments from the Rogue River and Siskiyou National Forests. They would range from 0.5 percent to 1.0 percent of the total payments to counties in Oregon.

Table 4-29

Average Annual Reductions in Payments to Counties During the Planning Period by Impact Areas, for Representative Alternatives[1/]

Impact Area	Alt. F		Alt. I		Alt. L	
	MM$	%	MM$	%	MM$	%
Puget Sound	.8	8	2.4	25	4.8	50
Olympic Penniusula	.8	5	3.3	19	9.9	56
Southwest Washington	.5	3	2.0	13	9.8	63
Central Washington	.6	6	2.0	20	2.6	26
Subtotal Washington	2.7	5	9.7	18	27.1	51
Northwest Oregon	1.0	5	3.9	21	10.2	56
West Central Oregon	2.8	6	10.1	22	29.3	65
Southwest Oregon	1.8	5	6.2	19	15.6	48
Central Oregon	.5	2	2.2	10	3.5	16
Subtotal Oregon	6.1	5	22.4	19	58.6	49
Total Region	8.8	5	32.1	19	85.7	50

[1/] Additional reductions in payments to counties in California: F - $0.1, I - $0.2, L - $0.3 million.

Finally, the states and counties, as well as the Federal government, would face reductions in tax revenues. These are summarized in Table 4-30. The most significant reductions in local and state tax payments, including decreases in property taxes which have not been included, would occur in the same communities that are most vulnerable to reductions in their economic bases, as shown in Figure 4-4.

Civil Rights, Minorities and Women

The effect of any alternative on minorities and women is directly related to the percentage of the work force that are minorities and women, and the affect that alternative has on regional employment.

The designation and management of northern spotted owl habitat will have little or no effect on the practice of traditional religions by Indians as provided for in the American Indian Religious Freedom Act of 1978. The affected Tribes will be consulted when ground disturbing activities necessary for management of owl habitat are proposed. Rights of Indians regarding traditional or cultural uses of National Forest lands and resources established by treaty will not be affected by designation and management of owl habitat. Indian cultural practices are often associated with the early successional stages of forest development. An example is wild huckleberries which provide a source of food and a tradition within the Indian culture of the southern Washington Cascades. The huckleberries commonly occur in old burns and recent clearcuts where the shading effects of a conifer canopy have been removed. Plant cover and berry production decrease considerably in stands characterized as spotted owl habitat.

Table 4-30

Average Annual Reductions in Direct Tax Payments by Businesses and Individuals to States and U.S. Treasury[1/]

Alternative	Washington	Oregon	Federal
	------ Million Dollars -----		
B	0	0	0
C	0	0	0
D & F*	.4 - 0.6	.8 - 1.5	4.0 - 7.3
E	.4 - 0.8	1.6 - 2.9	6.6 - 12.7
G	.7 - 1.4	1.9 - 3.4	9.1 - 17.4
H	1.3 - 2.6	1.9 - 3.4	12.0 - 23.0
I	1.2 - 2.2	2.9 - 5.3	14.4 - 27.5
J	1.5 - 2.8	4.1 - 7.3	19.5 - 37.1
K	2.0 - 3.7	5.4 - 9.8	25.8 - 48.9
L	3.1 - 5.8	7.7 -13.7	37.2 - 71.0

* Perferred Alternative

[1/] See Appendix H for calculations and assumptions. Entries of zero indicate less than $100,000. Personal taxes account for about 50 percent, 88 percent, and 43 percent of the payments to Washington, Oregon and the Federal government, respectively. Less reliable estimates of nondirect taxes, which would be paid because of the "multiplier effect," can be obtained for personal taxes (business taxes) by multiplying payments to Washington, Oregon, and the Federal government, respectively, by 0.95 (1.4), 1.4 (0.3), and 0.6 (1.6).

THE COMPATIBILITY WITH CURRENT DIRECTION AND PROPOSED STRATEGIES OF OTHER ORGANIZATIONS

USDA Forest Service, Southwestern Region (Arizona and New Mexico)

There is currently no regional policy specific to the spotted owl in the Southwestern Region. Individual National Forests have established 300 acre core areas around owl nests within their old-growth allocations. The Mexican race of owls exhibit different habitat preferences than the northern race.

Among these differences are using smaller areas of habitat, multiple occupancy of habitat areas, and populating desert island areas which have been isolated by as much as 80 miles of desert.

Since the sub-species requirements for habitat differ between the northern and Mexican races, there does not appear to be an inconsistency between the Pacific Northwest Region's current direction and proposed strategies and those being considered in the Southwestern Region.

USDA Forest Service, Pacific Southwest Region (California)

The Pacific Southwest Region planning direction has implemented 1000 acre habitat areas based on the same network system used in the Pacific Northwest Region. In the Pacific Southwest Region, a 25 percent overlap in adjacent habitats is permitted, in the Pacific Northwest Region no overlap is permitted in designating areas. In the Pacific Southwest Region, replacement acres are established for designated areas, in the Pacific Northwest Region these are not required although some National Forests have selected to do this in conjunction with a managed rather than dedicated approach to designated habitat.

For the Pacific Northwest Region, Supplement Alternatives A, B, and C provide smaller areas than Pacific Southwest Region direction, which require 300 acre habitats, and Alternatives F, G, H, I, J, K, and L, which require greater than 1000 acre habitats, provide more acres per individual habitat area than Pacific Southwest Region direction. The northern race does exhibit a higher density of occupancy toward the southern end of its range, suggesting that smaller habitat areas maybe warranted in California and, perhaps, southwest Oregon.

Bureau of Land Management

The Bureau of Land Management (BLM) is currently operating under an agreement with the Oregon Department of Fish and Wildlife. This agreement is to manage BLM administered lands in Oregon for 90 pairs of owls. The agency has implemented this by designating habitat areas of various sizes depending on availability. One site has 26 acres while others have as much as 800 acres. Pacific Northwest Region Alternatives B and C, with 300 acres habitat areas, are most compatable with the BLM direction. Alternative A, with no habitat designation, is not. Alternatives D, E, F, G, H, I, J, K, and L, which allocate areas greater than 300 acres, are not compatable, either. The Bureau initiated an effort on March 2, 1986, to prepare a white paper on spotted owl management. This paper is to be completed for review by the Assistant Secretary of the Interior by May 28, 1986. It should also be noted that the BLM-State of Oregon agreement calls for management by numbers of pairs rather than numbers of habitat areas.

National Park Service

The National Park Service, according to Jim Larson of their Seattle office, has made a conscious decision to avoid designating owl habitat areas. Their estimate of habitat within National Park Service jurisdiction is 530,300 acres, which it is believed would support 61 pairs of owls. The current direction and proposed strategies in the Pacific Northwest Region Supplement are compatible with current Park Service direction, since in all cases this habitat and resulting pair number is held as a constant.

Other State and Federal Agencies

The states of Oregon and Washington currently have no direction within their land managment agencies to manage for owl pairs or habitat areas. The Washington Department of Natural Resources is, however, considering the designation of three owl habitat areas in the vicinity of the Olympic National Park. Spotted owl habitat on lands administered by other Federal agencies, including the Bureau of Indian Affairs and Fish and Wildlife Service totals less than 2000 acres. There is currently no direction or proposed strategies for these lands; therefore, Pacific Northwest Region Supplement Alternative A is compatible with current direction on these lands. The two state forest management agencies in particular have suitable and capable habitat which could contribute significantly to avoiding the isolation of populations. Any of the other alternatives could be considered not comparable, since they have distribution requirements for both suitable and capable habitat areas.

Refer to Appendix D for a discussion of interagency coordination with monitoring and research needs.

Chapter 5

LIST OF PREPARERS

Interdisciplinary Team

Betsy (Bailey) Sparks is an economist with the Land Management Planning Unit in the Washington Office. She has a Bachelor of Arts in Economics from the University of Missouri at Columbia (1978) and a Master of Science in Forest Management from Oregon State University (1985). Betsy has worked for the Forest Service for seven years in positions in the Pacific Northwest Regional Office and on the Gifford Pinchot National Forest.

Kathy Johnson is a wildlife biologist in the Fish and Wildlife Unit of the Pacific Northwest Regional Office. She has a Bachelor of Arts in Biological Sciences, Verterbrate Ecology, from Central Washington State College (1977). Kathy has worked for the Forest Service for six years in positions on the Okanogan and Willamette National Forests, including that of planning biologist with the Land Management Planning Team on the Willamette National Forest.

Tom Ortman is a forester with the Division of Timber Management in the Pacific Northwest Regional Office. He has a Bachelor of Science in Forest Management from Michigan State University (1967) and a Master of Forestry in Forest Engineering from Oregon State University (1977). Tom has worked for the Forest Service for 18 years in various positions on the Boise, Payette, Winema, and Mt. Hood National Forests, as well as in the logging systems and timber planning sections of Timber Management in the Pacific Northwest Regional Office.

Len Volland is a statistical plant ecologist with the Division of Range and Watershed in the Pacific Northwest Regional Office. He has a Bachelor of Science in Forestry from the University of Idaho (1959), a Master of Science in Range Management from Oregon State University (1963), and a Doctor of Philosophy in Quantitative Ecology from Colorado State University (1973). Len has worked for the Forest Service for 27 years in positions on the Payette, Winema, and Caribou National Forests, and in the Pacific Northwest Regional Office.

Analysts

Kendrick Greer is an operations research analyst with the Pacific Northwest Regional Office. He has a Bachelor of Science in Forestry from Utah State University (1979). Kendrick has worked for the Forest Service for six years on the Siskiyou National Forest and in the Pacific Northwest Regional Office.

Richard (Holt) Holthausen is a wildlife ecologist with the Pacific Northwest Regional Office. He has a Bachelor of Science in Ecology from Cornell University (1973) and a Master of Science in Ecology from Utah State University (1977). Holt has been with the Forest Service for six years. He has worked as a forest planner on the Bighorn National Forest, and as a wildlife ecologist in the Wildlife and Fish Ecology Unit, Fort Collins, as well as in his present position.

Bruce Marcot is an ecologist on temporary assignment with the Regional Office. He has a Bachelor of Science in Natural Resources Planning and Interpretation (1977) and a Master of Science in Natural Resources Science, Wildlife Emphasis (1978), both from Humboldt State University. He also has a Doctor of Philosophy in Wildlife Science from Oregon State University (1984). Bruce has worked on a contractual basis for the U.S. Department of Interior, Fish and Wildlife Service. He has worked for the Forest Service since 1975 in various positions on the Six Rivers National Forest and in the Pacific Northwest Regional Office.

Nancy Warren is a biologist in the Regional Office. She has a Bachelor of Science in Wildlife Biology from Colorado State University (1976) and a Master of Science in Wildlife Management from the University of Idaho (1979). Nancy has worked for the Forest Service for six years in various positions on the Boise, Sawtooth, Challis, Shasta-Trinity, and Okanogon National Forests and in the Pacific Northwest Regional Office.

Major Contributors

Edie Asrow is a district wildlife biologist on the Klamath National Forest. She has a Bachelor of Arts in Journalism and Urban Studies from Syracuse University, Syracuse, New York (1973), and a Master of Science in Wildland Resource Science from the University of California at Berkeley (1978). Edie has worked for the Forest Service for a total of eight years. She worked for the Pacific Southwest Regional Office for two years in work-study programs and has been on the Klamath National Forest for six years as a wildlife biologist.

Ron Auler is a wildlife biologist on the Clackamas Ranger District of the Mt. Hood National Forest. He has a Bachelor of Arts in Biology from Hanover College, Hanover, Indiana (1971). He has done Post-Bachelor work in Ecology at the University of Wisconsin at Madison (1974) and in Wildlife Biology at Oregon State University (1980). Ron worked for the Bureau of Land Management for one year and has been with the Forest Service for seven years in positions on the Mapleton Ranger District, Siuslaw National Forest, and the Clackamas Ranger District.

Kathy Bowman is a writer and editor with the Research Information Services of the Pacific Northwest Research Station. She has an Associate of Science in Forestry Technology (1975) and Associate of Arts in Liberal Arts (1976), both from Central Oregon Community College, and a Bachelor of Arts in from Marylhurst College (1979). The Bachelor of Arts is Interdisciplinary in Communication, Geography and Writing. Kathy has worked for the Forest Service for five years in positions on the Siskiyou National Forest and in the Pacific Northwest Regional Office.

Marie (Bonnie) Degray is a forestry technician on the Clackamas District of the Mt. Hood National Forest. She has an Associate in Forestry from Mt. Hood Community College. Bonnie has worked six years on the Mt. hood National Forest.

Nancy Dobbs is a biologist with the Wildlife and Fish Ecology Unit at Fort Collins, Colorado. She has a Bachelor of Science in Wildlife Science from Texas Tech University. Nancy has worked for the Forest Sevice for four years on the Arapaho and Roosevelt National Forests and in the Wildlife and Fish Ecology Unit.

Herb Evans is a public affairs officer with the Zigzag Ranger District on the Mt. Hood National Forest. He has a Bachelor of Science in Park Administration from Arkansas Polytechnic College (1973). Herb has worked for the Forest Service for 13 years in positions on the Ozark, Superior, and Mt. Hood National Forests.

Eric Forsman is a consulting biologist. He has a Bachelor of Science in Wildlife Science (1972), and a Master of Science (1975) and a Doctor of Philosophy (1980), both in Wildlife Management. All his degrees are from Oregon State University. Since 1980, Eric has done work for the Forest Service, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the British Columbia Ministry of Environment, the Oregon Department of Fish and Wildlife, and the Pacific Northwest Experiment Station of the Forest Service.

Rick Kneeland is wildlife biologist on the Mt. Hood National Forest. He has a Bachelor of Arts in Biological Sciences from Nazarine College, Napa, Idaho (1975). Rick has worked for the Forest Service for 11 years. He has been on the Columbia Gorge Ranger District and in the Supervisor's Office of the Mt. Hood National Forest.

Sandra Knight is a wildlife biologist on the Gifford Pinchot National Forest. She has a Bachelor of Arts (1973) from Washington University, St. Louis, Missouri, and a Master of Science (1979) in Wildlife Biology from Utah State University. Sandra worked for the U.S. Fish and Wildlife Service for four years. She has worked for seven years with the Forest Service in various positions in the Pacific Northwest Regional Office and on the Gifford Pinchot National Forest. Her work on the Gifford Pinchot included three years in Land Management Planning, one year of which was on the plan for the Mount St. Helens National Volcanic Monument.

Con Schallau is a research forest economist with the Pacific Northwest Research Station in Corvallis, Oregon. He has a Bachelor of Science from Iowa State (1954) and a Master of Science (1958) and Doctor of Philosophy (1961) in Forestry Economics from Michigan State University. Con has work for the Forest Service for 31 years in positions with the North Central, Intermountain, and Pacific Northwest Forest and Range Experiment Stations.

Denny Schweitzer is an assistant director of Land Management Planning in the Washington Office. He has a Bachelor of Science in Forest Management from Penn State (1961) and a Master of Science (1963) and Doctor of

Philosophy (1968) in Forest Economics from the University of Minnesota. Denny has worked for the Forest Service for 23 years in positions with North Central, Pacific Northwest, Intermountain and Rocky Mountain Forest and Range Experiment Stations and the policy analysis staff in the Washington Office.

Gretchen Starke is an editor on temporary assignment with the Land Management Planning Division in the Pacific Northwest Regional Office. She has a Bachelor of Science in Zoology from Iowa State College (1959). In addition to volunteer and free-lance work, Gretchen worked for the U.S Army Corps of Engineers, Portland District, as a technical writer and editor for five years and for the Forest Service for one year as a writer and editor in Land Management Planning on the Mt. Hood National Forest.

Brian Wall is a research forest economist with the Pacific Northwest Research Station in Portland, Oregon. He has a Bachelor of Science in Forest Management from the University of Washington (1962) and a Master of Forestry from Yale University (1964). In addition to working for private industry and the State of Washington, Department of Natural Resources, Brian has worked for the Forest Service for 22 years in positions on the Mt. Baker-Snoqualmie National Forest and the Pacific Northwest Research Station.

Chapter 6

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

AGENCIES

Agriculture Research Service
Bend Metro Parks and Recreation District
California, State of--Department of Fish and Game
California, State of--Office of the Governor
Congressional Research Service
Coos County (OR) Planning Department
Corvallis, City of--Utility Department
County Boards of Commissioners
- Adams County (WA) Board of Commissioners
- Asotin County (WA) Board of Commissioners
- Baker County (OR) Board of Commissioners
- Benton County (OR) Board of Commissioners
- Benton County (WA) Board of Commissioners
- Chelan County (WA) Board of Commissioners
- Clackamas County (OR) Board of Commissioners
- Clallam County (WA) Board of Commissioners
- Clark County (WA) Board of Commissioners
- Clatsop County (OR) Board of Commissioners
- Columbia County (OR) Board of Commissioners
- Columbia County (WA) Board of Commissioners
- Coos County (OR) Board of Commissioners
- Cowlitz County (WA) Board of Commissioners
- Crook County (OR) Board of Commissioners
- Curry County (OR) Board of Commissioners
- Deschutes County (OR) Board of Commissioners
- Douglas County (OR) Board of Commissioners
- Douglas County (WA) Board of Commissioners
- Ferry County (WA) Board of Commissioners
- Franklin County (WA) Board of Commissioners
- Garfield County (WA) Board of Commissioners
- Gilliam County (OR) Board of Commissioners
- Grant County (OR) Board of Commissioners
- Grant County (WA) Board of Commissioners
- Grays Harbor County (WA) Board of Commissioners
- Harney County (OR) Board of Commissioners
- Hood River County (OR) Board of Commissioners
- Island County (WA) Board of Commissioners
- Jackson County (OR) Board of Commissioners
- Jefferson County (OR) Board of Commissioners
- Jefferson County (WA) Board of Commissioners

Josephine County (OR) Board of Commissioners
Kitsap County (WA) Board of Commissioners
Kittitas County (WA) Board of Commissioners
Klamath County (OR) Board of Commissioners
Klickitat County (WA) Board of Commissioners
Lake County (OR) Board of Commissioners
Lane County (OR) Board of Commissioners
Lewis County (WA) Board of Commissioners
Lincoln County (OR) Board of Commissioners
Lincoln County (WA) Board of Commissioners
Linn County (OR) Board of Commissioners
Malheur County (OR) Board of Commissioners
Marion County (OR) Board of Commissioners
Mason County (WA) Board of Commissioners
Morrow County (OR) Board of Commissioners
Multnomah County (OR) Board of Commissioners
Okanogan County (WA) Board of Commissioners
Pacific County (WA) Board of Commissioners
Pend Oreille County (WA) Board of Commissioners
Polk County (OR) Board of Commissioners
San Juan County (WA) Board of Commissioners
Sherman County (OR) Board of Commissioners
Skagit County (WA) Board of Commissioners
Skamania County (WA) Board of Commissioners
Spokane County (WA) Board of Commissioners
Stevens County (WA) Board of Commissioners
Thurston County (WA) Board of Commissioners
Tillamook County (OR) Board of Commissioners
Umatilla County (OR) Board of Commissioners
Union County (OR) Board of Commissioners
Wahkiakum County (WA) Board of Commissioners
Walla Walla County (WA) Board of Commissioners
Wallowa County (OR) Board of Commissioners
Wasco County (OR) Board of Commissioners
Washington County (OR) Board of Commissioners
Wheeler County (OR) Board of Commissioners
Whitman County (WA) Board of Commissioners
Yakima County (WA) Board of Commissioners
Yamhill County (OR) Board of Commissioners

County Executives
King County (WA)
Pierce County (WA)
Snohomish County (WA)
Whatcom County (WA)

Curry County (OR) Planning Department
Douglas County (OR) Land Department
Federal Aviation Administration
Federal Emergency Management Agency
Federal Energy Regulatory Commission
Federal Highway Administration
Federal Railroad Administration
General Services Administration, Environmental Staff
Interstate Commerce Commission

Idaho, State of--Division of Environment
Josephine County (OR) Planning Department
Kittitas County (WA) Planning Office
Metropolitan Service District (Portland, OR)
National Oceanic and Atmospheric Administration
National Aeronautics and Space Administration
National Marine Fisheries Service, Northwest and Southwest Regions
Nuclear Regulatory Commission
Oregon, State of--Department of Agriculture
Oregon, State of--Department of Energy
Oregon, State of--Department of Environmental Quality
Oregon, State of--Department of Fish and Wildlife
Oregon, State of--Department of Geological and Mining Industries
Oregon, State of--Department of Land Conservation and Development Commission
Oregon, State of--Department of Transportation
Oregon, State of--Office of the Governor
Oregon, State of-- State Parks
Salem, City of
Seattle City Light
U.S. Army, Corps of Engineers
U.S. Coast Guard
U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service
U.S. Department of Agriculture, Animal and Plant Health Inspection Service
U.S. Department of Agriculture, Forest Service
U.S. Department of Agriculture, Office of Equal Opportunity
U.S. Department of Agriculture, Rural Electrification Administration
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Energy, Bonneville Power Administration
U.S. Department of Energy, Office of Environmental Compliance
U.S. Department of Energy, Richland Operation Office
U.S. Department of Defense
U.S. Department of Health and Human Services
U.S. Department of Housing and Urban Development
U.S. Department of the Interior, Bureau of Indian Affairs
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of the Interior, National Park Service
U.S. Department of the Interior, Office of Policy Analysis
U.S. Department of Labor
U.S. Department of Transportation
U.S. Environmental Protection Agency, EIS Review Coordinator, Regions 9 and 10
U.S. Environmental Protection Agency, Office of Environmental Review
U.S. Fish and Wildlife Service
U.S. Fish and Wildlife Service, Department of Ecological Services
U.S. Fish and Wildlife Service, Office of Migratory Birds
U.S. Navy, Environmental Protection Division
U.S. Navy, Naval Oceanography Divison
Washington, State of--Department of Ecology
Washington, State of--Department of Emergency Services
Washington, State of--Department of Fisheries
Washington, State of--Department of Game

Washington, State of--Office of the Governor
Washington, State of--Department Natural Resources
Washington, State of--Department of Parks and Recreation
Washington, State of--Department of Transportation

ORGANIZATIONS

AAA Auto Club of Washington
Allstate Izaak Walton League
Alpine Lakes Protection Society
Alternatives to Pesticides
American Alpine Club
American Fisheries Society, Western Division
American Forest Institute
American Forestry Association
American Institute of Biological Sciences
American Mining Congress
American Museum of Natural History
American Society of Landscape Architects, Washington
Arcata Redwood
Archaeological Associates Northwest, Inc.
Arizona Daily Star
Association of General Contractors
Associated Oregon Loggers
Association of O&C Counties
Association of Oregon Archaeologists
Attorneys-at-Law, McAteer, Hanken, Borgerson and Lenihn
Audubon Society
Avison Lumber Company
Backcountry Horseman of Washington
Bald Knob Land and Timber Company
Batelle Pacific Northwest Laboratory
Beak Consultants
Black Hills Audubon Society
Blue Mountain Intergovernmental Council
Bohemia Mine Owners Association
Bohemia, Incorporated
Boise Cascade Corporation
Breitenbush Hot Springs
Broughton Lumber Company
Bulletin (Bend, OR)
Buse Timber and Sales, Incorporated
CCO Economic Improvement Association
California Wilderness Coalition
Cascade Chapter Sierra Club
Cascade Field and Stream Club
Cascade Holistic Economic Consultants
Cathedral Forest Action Group
Central Cascades Conservation Committee
Central Cascades Conservation Council
Central Oregon Community College
Central Washington University, Biological Sciences

Chehalis Business Council
Cispus Environmental Center
Clark College
Clark/Skamania Flyfishers
Clatsop-Tillamook Intergovermental Council
Colorado State University
Columbia Basin Fish and Wildlife Council
Columbia Gorge Coalition
Columbia River Intertribal Fish Commission
Coos Chapter Society of American Foresters
Corvallis Audubon Society
Colville Business Council
Cowlitz County Advocate
Cowlitz Game and Anglers
Cowlitz Indians
Cowlitz Wahkiakum Government Conference
Crown Zellerbach Corporation
Curry Coastal Pilot (Brookings, OR)
Curry County Reporter (Gold Beach, OR)
Daily Chronicle (Centralia, WA)
Daily Courier (Grants Pass, OR)
Daily Olympian (Olympia, WA)
Defenders of Wildlife
Dendro Protection Service
Denver Public Library
Dipaolo Logging Company
Doss Construction Company
Douglas County (OR) Library
Douglas County (OR) Museum
Douglas County (OR) Protective Association
Douglas County (OR) Water Resources
Douglas Pacific Lumber Company
Douglas Timber Operations, Incorporated
Dr. Johnson Lumber Company
Duval Corporation
Eagle Lake Chapter Aububon Society
East Central Oregon Association of Counties
East Multnomah SWCO
Eastern Lewis Safety Council
Eastern Washington University
Ed Willinston Association, Incorporated
Ellingson Lumber Company
Environmental Education
Environmental Research and Technology
Eugene Register Guard (Eugene, OR)
Evergreen Legal Services
Federation of Western Outdoor Clubs
Forest Planning Magazine
Forest Resource Library
Fort Hill Lumber Company
Fort Vancouver Regional Library
Four Wheelers
Franklin High School Library

Frank Lumber Company
Friends of Indian Heaven
Friends of the Earth
Friends of the Snohomish River Delta
Fruit Growers Supply Company
G and D Company
Georgia Pacific Corporation
Gilchrist Timber Company
Giustina Brothers
Goldendale Sentinel
Guy Roberts Lumber Company
Hampton Industries
Harold Barclay Logging, Incorporated
Helicopter Loggers Association
Herbert Lumber Company
Hi-Ridge Lumber Company
Hoh Tribal Business Council
Hood Canal Environmental Council
Hoskins Lumber Company
Humboldt State University
Hume Library of Federal Documents
Ida-Ore Regional Planning and Development Association, Incorporated
Industrial Forestry Association
Inland Empire Big Game Commission
Interagency Commission for Outdoor Recreation
Interagency Motor Equipment Advisory Commission
Intergovernmental Reltions Division
Intergovernmental Resource Center
International Paper Company
International Snowmobile Association
Izaak Walton League of America
Jamestown Clallam Indian Tribe
Jeeping Nomads, Incorporated
John C. Taylor Lumber Sales, Incorporated
Josephine Soil and Water Conservation District
Juniper Sierra Club
KCMX Radio (Ashland, OR)
KCRF Radio (Lincoln City, OR)
KNPT News (Newport, OR)
KOGAP Manufacturing Company
KOIN-TV (Portland, OR)
KPIC-TV (Rosebury,OR)
KQEN (Roseburg, OR)
KVAL-TV (Eugene, OR)
Kalama Public Library
Kalispel Business Council
Kalmiopsis Action Alliance
Keep Oregon Green
Keep Washington Green
King Bearing
Klamath County (OR) Library
Klamath-Lake Planning and Coordinating Council
Lake County (OR) Library

Lake Wenatchee State Park (WA)
Land Conservation and Development Library
Lane Council of Governments
Lane County Audubon Society
Larry Brown and Associates
League of Women Voters
League of Women Voters of Oregon
Lewis River Chapter of Northwest Steelheaders
Lewis River News (Woodland, WA)
Lewis and Clark College
Lewis and Clark Law School
Lively Livestock 4-H Club
Longview Chamber of Commerce
Longview Public Library
Lower Elwha Tribal Council
Lumni Indian Business Council
Makah Tribal Council
Malheur Lumber Company
Management Operation Company, Limited, United Kingdom
Mansanto Company
Marble Mountain Audubon Society
Mary's Peak Sierra Club
Mary's River Lumber Company
Mazamas
McKenzie Guardians
Mid-Columbia Economic Development District
Mid-Willamette Valley Council of Governents
Morton School Board
Morton School District Number 214
Mossyrock Saddle Club
Mother Lode Chapter Sierra Club
Mountain Fir Lumber Company, Incorporated
Mt. Adams Veneer
Mt. St. Helens Protective Association
Mt. St. Helens Track and Riders
Muckleshoot Tribal Council
Multnomah County Library
Multnomah Plywood Corporation
Myrtle Point Herald (Myrtle Point, OR)
Northwest Ecological Research Institute
National Association for River Sports
National Audubon Society
National Endowment for the Arts
National Forest Products Association
National Forest Recreation Association
National Speleogical Society, Western Survey
National Wildlife Federation
Native Plant Society of Oregon
Natural Resources Defense Council
Nature Conservancy
Newqually Tribal Council
No Cut in Little Buck Committee
Nooksack Indian Tribal Council

North Bend Information Center
North Cascades Conservation Council
Northcoast Environmental Center
Northside Lumber Company
Northwest Coalition for Alternatives to Pesticides
Northwest Forest Workers
Northwest Independent Forest Manufacturers
Northwest Indian Fisheries Commission
Northwest Izaak Walton League
Northwest Joint Office Society of American Foresters
Northwest Pine Association
Northwest Power Planning Council
Northwest Rafters Association
Northwest Representative Sierra Club
Northwest Road and Trail
Northwest Small Hydro Association
Northwest Steelheaders
Northwest Timber Association
Obsidians
Obsidian Aububon Society
Obsidian Sierra Club
Okanogan Wilderness League
Olympic Park Association
Olympic Penisula Audubon Society
Oregon Archaeological Preservation Committee
Oregon Association of Nurserymen
Oregon Association of Soil and Water Conservation Districts
Oregon Board of Engineering Examiners
Oregon Board of Geographic Names
Oregon Cattlemen's Association
Oregon Division Izaak Walton League
Oregon Environmental Council
Oregon Forest Industries Council
Oregon Forest Protection Association
Oregon Guides and Packers, Incorporated
Oregon High Desert Museum
Oregon Hunter's Association
Oregon Natural Resources Council
Oregon Outdoors
Oregon Sheepgrowers Association
Oregon Small Woodlands Association
Oregon Sportsmen
Oregon State University
Oregon Trout
Oregon Water Policy Renew Board
Oregon Wilderness Coalition
Oregon Wildlife Federation
P and M Cedar Products
PNW 4-Wheel-Drive Association
Pacific Lumber and Shipping Company
Pacific Marine Technology
Pacific Northwest Ski Areas Association
Whitman College

Phoenix Reforestation
Plum Creek Timber Company, Incorporated
Point No Point Treaty Council
Polk County Planning Director
Port Gamble Business Committee
Portland Audubon Society
Portland State University
Powder River Sportsmen Club
Private Nursery Industry
Public Interest Research Group - Oregon Student
Publishers Paper Company
Puyallup Tribal Council
Quileute Tribal Council
Redwood Chapter Sierra Club
Resources Limited
Rex Timber Incorporated
Rogue Community College
Rogue Group Sierra Club
Rogue Valley Audubon Society
Rogue Valley Council of Governments
Rosboro Lumber Company
Roseburg Area Chamber of Commerce
Roseburg Lumber Company
SWOCC-Forestry
Salem Audubon Society
Santiam Fish and Game Association
Sauk-Suiattle Indian Tribal Council
Seattle Audubon Society
Seattle Public Library
Shoalwater Bay Tribal Council
Sierra Club of Oregon
Simpson Timber Company
Siskiyou Audubon Society
Siskiyou Regional Education Project
Siuslaw Task Force
Skikomish Tribal Council
Sno-Engineering, Incorporated
Society for Animal Protective Legislation
Society of American Foresters, National Office
Soncap
South Coast Lumber Company
Southern Oregon Resource Alliance
Southern Oregon State College
Sourthern Oregon Timber Industries Association
Southwest Forest Industries
Spalding and Son, Incorporated
Spokane Business Council
Squaxin Island Tribal Council
Stanford University
Starker Forests, Incorporated
Stillaguamish Board of Directors
Stimson Lumber Company
Sun Country Estates

Sunny Pine Farm
Sunriver Properties
Sunstar
Suquamish Tribal Council
Swinomish Indian Senate
3-G Lumber Company
Tacoma Audubon Society
Tatoosh Group Sierra Club
The American Museum of Natural History
The Choice, News Tribune (Kelso, WA)
The Columbian (Vancouver, WA)
The Conservation Foundation
The Daily News (Longview, WA)
The Enterprise (White Salmon, WA)
The Evergreen State College (Olympia, WA)
The Herald (Lynnwood, WA)
The Klamath Indian Game Commission
The Klamath Tribe
The Mountaineers
The Nature Conservancy
The News Tribune (Tacoma, WA)
The Oregonian (Portland, OR)
The Wilderness Society
Tierra Madre Consultants
Timber and Land Use Planning
Timber and Wood Products Group
Times Mirror Land and Timber Company
Trail Club of Oregon
Treasure Valley Community College
Trout Unlimited
Tulalip Board of Directors
Tulalip Tribes
Umpqua Regional Council of Governments
Umpqua Valley Audubon Society
Umpqua Wilderness Defenders
University of Arkansas, School of Law
University of California, Jurisprudence and Social Policy Program
University of California--Berkeley
University of California--Davis, Department of Environmental Studies
University of California--San Diego, Department of Biology
University of Chicago, Department of Biology
University of Florida, School of Forest Resources and Conservation
University of Oregon, Survival Center
University of Pittsburg
University of Washington, College of Forest Resources
University of Wisconsin, Department of Wildlife Ecology
Upper Skagit Tribal Council
Vancouver Audubon Society
Waldo Mining Distributors
Waldo Wilderness/Hardesty/Mt. June
Wallowa County Chamber of Commerce
Wallowa Lake Forest Industries, Incorporated
Wallowa Resource Council

Ward Northwest, Incorporated
Washington Archaeological Research Center
Washington Audubon Society
Washington Chapter of The Wildlife Society
Washington County District Court
Washington Cattlemen's Association
Washington Environmental Council
Washington Farm Forestry Association
Washington Forest Protection Association
Washington Native Plant Society
Washington State Association of Counties
Washington State Horsemen, Incorporated
Washington State Mineral Council
Washington State Snowmobile Association
Washington State Sportsmen's Council
Washington State University
Washington Wilderness Coalition
Webco Forest Products, Incorporated
Wenatchee Outdoor Club
Wenatchee Sportsmen's Association
Wenatchee Valley College
Western Forest Industries Association
Western Forestry and Conservation Association
Western Forestry Center
Western Lane Sportsmen's Association
Western Wood Products Association
Weyerhaeuser Company
White Pass School District
Wild Land Evaluation, Incorporation
Wildlife Management Institute
Willamette Crushing Company
Willamette Industries
Yakima Tribal Council
Yosemite Institute

ELECTED OFFICIALS

U.S. House of Representatives

Les AuCoin	Don Bonker
Douglas H. Bosco	Ron Chandler
Larry E. Craig	Norman Dicks
Thomas Foley	Mike Lowry
John Miller	Sid Morrison
Norman D. Shumway	Bob Smith
Denny Smith	Al Swift
Jim Weaver	Ron Wyden

U.S. Senate

Alan Cranston	Dan Evans
Slade Gorton	Mark Hatfield

James McClure
Steve Symms
Bob Packwood
Pete Wilson

Other Elected Officials

Jack Beebe, Coos County (OR) Commissioner
Vernon Marll, Columbia County (WA) Commissioner
Dave Cooper, Linn County (OR) Commissioner

PERSONS

Edwin	Abbott	Cal	Baker
Mike	Achen	Jim	Baker
Teresa	Achenbach	M/M James A.	Baker
A	Ackerman	Cathy	Baldwin
Charles F.	Adams	Michael	Baldwin
John	Adams	Irene	Barchhuber
Rick	Adams	Richard	Barclay
Judy & Paul	Alaback	Marc	Bardsley
Janet	Alexander	Donald	Barr
Tom	Alkine	Laurence	Barrett
Michael	Allen	John	Barros
Rod	Allen	Roy	Bartheway
John	Allinger	Susan	Groves
Donald	Allison	R.R. & Nancy	Batie
Corinn G.	Almquist	Albert	Bauer
Thomas	Alway	George A.	Bauer
Ron	Anderason	Paul	Baumgarden
Barbara	Anderson	Rodney	Beamguard
D.	Anderson	Beverly	Beck
Dean	Anderson	Matthew	Beebe
Dr. Jean	Anderson	Dave	Bell
Martha	Anderson	Ruth	Bell
R.B.	Anderson	Reese	Bender
Albert	Angove	David	Bennett
Terry	Anshutz	James	Bennett
Ellis	Antrim	Sam	Benowitx
Howard	Appollonio	Louis	Benson
Janet	Archibald	Pete	Bentley
Glen	Ardt	C.J. & Irene	Bernards
Bonnie	Argo	James V.	Beslow
Helen	Arkoosh	Peter S.	Bidlake
Arthur	Arp	Robert	Bieler
Bill	Arthur	Darci	Birmingham
Dick	Ary	Martin	Birnbaum
Larry	Aschenbrenner	L.G.	Black
Carl	Austin	Bill	Blackwell
Mr. & Mrs.	B. W. Raymond	Jeff	Blaisdell
Irene	Bachhuber	Ray	Blaisdell
Robert	Bacus	Cecil	Blakley
William H.	Baer	Gary	Blanchard
Charles	Bagley	Lyle	Bland

Jeff	Blang
Joseph	Blazek
R.D.	Bliss
Doris	Blum-Etzell
Barb	Boaz
Sam	Boddy
R Q	Bohlig
Bert	Bonell
Carol	Booth
Michael	Bormuth
Jack	Bothwell
R. Ted	Bottiger
Jerry	Boughton
Katie	Boula
Nancy	Boulton
Earl D.	Bowen
Mitch	Bower
Larry	Bowman
Stephen	Bowman
Bud	Boyer
Marilyn	Boysen
Bob	Braden
Byron	Braden
Eleanor	Bradley
Diana	Bradshaw
Dave	Braley
Vincent	Brand
Robert	Brandes
Otto	Brandt
Christopher	Bratt
Kalman	Brauner
Jon	Brazier
Bruce	Brewer
Sherri	Brewer
Phillip	Briegleb
Richard	Briggs
M.C.	Brodie
Charles	Brown
Darci	Brown
David	Brown
John P.	Brown
John	Bruneau
Bary	Bruner
M.E.	Bryant
Mark	Buckbee
Richard	Buckmaster
Karl	Buehler
E.	Buettgenbach
Norman	Buhman
Alice H.	Bull
Darryl	Bullington
Ted	Bumsted
K.T.,	Bunker
James	Burchfield
Ginger	Burns
LeRoy	Burns
Eric	Burr
Amel	Burris
Melvin	Butterfield
Joseph	Butterworth
Dennis	Caird
James	Campbell
Richard	Campbell
Tom	Campion
Mel	Canal
James	Capurso
Kevin P.	Carbin Jr.
Darrell	Carlson
John	Carlson
Richard	Carlson
May M.	Carrell
George	Cashdollar
Wayne	Chambers
Paul	Chantiny
Stuart	Chapin
Dale	Chapman
Galen	Chapman
D.B.	Charlton
Jack	Cheney
Robert and	Cheryl Cole
George	Chesley
Mark & Judy	Chilcote
David	Chill
Larry	Chitwood
Julie	Christensen
Bob	Christian
Charlene S.	Christian
Richard	Christianson
Jere	Christner
Daily	Chronicle
Daniel L.	Ciske
Basil	Clark
David L.	Clark
Fred	Clark
Joseph	Clark
Ron	Clark
Virgil L.	Clark, Jr.
Lloyd	Claymier
Carl	Clemons
Leonard	Clevinger
Kim	Clough
Willard	Clucas
Jimmie	Cobb
Al	Coburn
Sharon	Cohen
A J	Colasurdo

Alvin	Colbert
Allen	Cole
Curtis	Coleman
Tim	Coleman
Warren	Coleman
Robert	Collier
Tim	Collins
Keith	Comstock
D	Conklin
Robert	Conner
Charles	Cooper
Harold	Cooper
Romain	Cooper
Andy	Coray
David	Corkran
Deborah	Cornett
Steve	Couche
Dennis	Coules
Tim	Cournyer
M.E.	Covert
Dennis	Cox
Linda	Craig
Lisa	Craig
Ray	Craig
Phil	Crawford
Jim	Creighton
James	Criswell
Jeff	Crook
Ray	Croswell
Alison	Crowe
Bob	Currey
Bob	Currie
Richard	Curtis
Robert	Curtis
Karen	Curtiss
Vera	Dafoe
Bev	Dahlin
Darwin	Dahm
Oliver	Dalton
M N	Dana
Rosella	Danzer
Nancy	Darling
Mike	Davenport
Brian	Davern
John	David
Harold	Davidson
Brad	Davis
Frank	Davis
Gail	Davis
Jack	Davis
Judy	Davis
Oliver	Davis
Ruben	Davis
Chancey	Davis, Sr.
Gordon R.	Dawson
Curtis	Day
Edward	DeCarlo
Elmer	DeRuwe
Stephen	DeStefano
Larry	Dean
Alex	Decclo
Harry	Demaray
Betty	Dension
Jack	Desmond
Paul	Dewey
R.E.	Dickason
Jess	Dixon
Nick	Dodge
James T.	Dodge, M.D.
Tim	Donivan
Stephen	Donnel
Fred and	Dorothy Behm
Herm	Dosher
Doc	Dotson
Ernie	Dotson
George	Draffan
M. C.	Dunham
Jean	Dunlop
Tom	Dunn
W.	Dunne
Jim	Durham
Eleanor	Dyke
Glenn	Eades
Jim	Eastman
David	Eddy
Leonard	Edlund
Cathy	Edwards
Mike	Elliot
Jerry	Elliott
Joseph	Ely
Patrick E.	Embum
Bill	Emmingham
David	Engel
David	Engle
Sue	Engle
Helen	Engle Martin
Joseph	Englemann
Jerry E.	English
David	Erion
Keith	Ervin
Curtis	Esch
Robert	Eschrich
Joseph	Esherick
W. B.	Eubanks
Diane	Evans
Robert	Evinger

Rich	Fairbanks
Jim	Fairchild
Richard	Farthing
Robert	Ferber
J.A.	Ferrara
S.E.	Fester
Warren	Fetter
Paul	Fielder
Don D.	Fife
Roger	Fight
Eino	Filla
Steve	Finneran
Bill & Velna	Fisher
Donald	Fisher
Irvin	Flathers
Jim	Fletcher
Ashton	Foerst
Barbara	Fontain
Janette	Ford
Jeff	Ford
Roy	Ford, Jr.
John	Forester
John	Forsberg
Rachmiel	Forschmiedt
Jeffrey R.	Foster
Susan	Foster
Barbara	Fox
Tom	Fox
C. E.	Francis
Alan	Franklin
Mrs. L.	Franklin
Steve	Frazier
Sam	Frear
John	Freemire
Leonard	Freese
Nancy	French
Ruth	French
M/M Robert	Frenkel
Robert	Freres
John	Frewing
M/M Howard	Frieman
Mary	Fries
Larry	Friesen
Robert	Fristad
Jim	Frost
R. W.	Frost
Kathy	Fuller
Robert	Fyfe
Helen	Gabrielsen
Kenneth	Galloway
John	Gambold, Jr.
Edwin	Gammell
Johyn	Gamon
Douglas	Gardner
Paul	Gardner
Roger C.	Garrett
Stuart	Garrett
Roy	Garten
Bob	Garver
Franklin	Gearhart
Margaret	Gebhard
Philip	Gemley
Anthony	George
Diane E.	George
Rick	George
William	George
Ed	Gerhard
Gregory	Gessay, M.D.
William	Giberson
Carol	Gilbert
Francis	Gladfelder
Helen	Glidewell
Beulah	Goble
Gerald	Goble
Lloyd	Goble
Lester	Godfrey
Jay	Goldammer
Kenneth	Goldsmith
Pat	Goldsworthy
S.	Golfman
Fred	Gonzales
Jessica	Gonzales
Roger	Goodwin
Merle	Gordon
Richard J.	Gordon
Bob	Gorman
Jim	Gorter
George	Gortman
Burt	Gossard
Howard	Grafton
Robert	Graham
Bill	Green
Carl	Green
Liz	Greenhagen
Tyler	Groo
Dean	Groshong
Sue	Groshong
Ray	Groth
Gerald	Gulliskson
Grant	Gunderson
Timothy	Gurton
R.	H.
Jonathan	Haber
Donald	Hack
Dean	Hackett
Tom	Haensly

Stephen	Hager
Dan	Hahn
Herbert	Haight
Harold	Hail
Brad	Hall
Sue	Hall
Joe	Hallett
Ed	Hamilton
John	Hammond
Robert P.	Hammond
Loma	Hammons
Ted	Handegard, Sr.
Eugene M.	Handerson
Elizabeth	Handler
Fred	Hansen
Mark	Hansen
Mel	Hansen
Richard	Hanson
Clifford	Harmon
Robert	Harn
Dennis	Harr
B. L.	Harris
Todd	Harris
Perry	Harvester
Steve	Harvey
Howard	Haskins
Jack	Hatcher
Mark	Hatcher
Mike	Hause
Charles	Hawkins
Laurence	Hawkins, Jr.
Stewart	Hazen
Kathy	Heimbigner
Allen	Heinemann
Ole	Helgerson
George	Helkey
Eleanor	Heller Dyke
William H.	Henlive
John	Henshow
P. Sydney	Herbert
Kurt	Herzog
Joan	Hett
Chris	Hiatt
Bob	Hildenbrand
Randy	Hinke
Joseph	Hinton
LeRoy	Hippe
Leighton	Ho
David	Hodges
Brett	Hodgson
Michael	Hoffman
Gerald	Holdgrafer
Susan	Hollenbeck
Jackson	Holloman
Ed	Holloran
Andrew	Holman
Joe	Holman
Kerry	Holman
Arthur T.	Holt
Clyde	Holt
Tom	Holt
Ronald E.	Holttum
Marvin	Hoover
Richard E.	Hope,Jr.
M.	Hornby
Eric	Horstman
H.G.	Horstman
Dean	Hostetter
Tim	Houlihan
Fred	House
Herman	Hovemann
Dave	Howard
Gloria	Howell
George	Hoyer
Mildred	Hubbert
Joseph J.	Hubbs
Betty	Hubka
James	Huett
Stan	Humann
Angela	Hunt
Howard	Huntington
Jim	Hutchison
Stephen H.	Huza
Richard	Inman
Michael	Irving
Jim	Irwin
Ruth	Itiner
Paul	Ivester
Gordon	Jackins
Andy	Jackman
Ellen	Jacobs
Joyce L.	Jacobs
Richard	Jali
Ed	Javorka
Marvin	Jemtegaard
Bill	Jerde
Pat	Jermov
Dave	Jessup
Bob	Johnson
Bob	Johnson
Harold	Johnson
Michael	Johnson
Richard	Johnson
Robert	Johnson
Rocky	Johnson
Ted	Johnson

Tomothy	Johnson
Russ	Joley
Alden	Jones
Charlie	Jones
Doug	Jones
Jeanne	Jones
L.J. & Lois	Jones
Loring M.	Jones
Michael	Jones
C. Glen	Jorgensen
Julia	Jose
Morton	Journal
William	Kadner
Erick	Karlsson
Ly	Katchia
James	Kauppila
Marsha	Kearney
Ty	Kearney
John	Keatley
Roy	Keene
Michael	Kellett
Mark	Kelley
Bud	Kelly
John D.	Kelly
Maia	Kelly
Lee	Kelson
Phillip	Kemp
B.	Kennedy
Kris & Cindy	Kennedy
Mike	Kerrick
Steven	Kessler
Ken	Kestner
Oscar	Ketcham
Madge	Keys
Charles D.	Kilbury
Les	Kile
J. Kimo	Kimokeo
David	King
Don	King
Joe	King
Linda	King
Michael	King
J. Daniel	Kinney
Chris	Kittell
Marcus	Kittock
Betty	Klattenoff
Gerald	Klepach
Jennifer	Klepach
Duane	Knapp
Teresa	Knodel
Craig	Knoll
Nancy	Knowles
L. I.	Knudson
John	Koch
Greg	Koerper
Bill	Koff
Mike	Koons
Zoltan	Kosa
Joe	Koshko
Diane	Kossen
Elizabeth	Krebill
Charles	Krebs
Don	Kreshak
Ben & Marge	Kriete
Nancy	Kroening
Dan H.	Krohn
H.R.	Kuhnhausen
Marlys	Lagerquist
Tom	Lagra
Ron	Lambert
Bernard	Lamping
Kevin J.	Landacre
Charles	Landgren
Lola	Landis
Laura	Lane
James	Langdon
Larry	Langdon
Butch	Larson
Charles	Larson
Willard	Latimer
Mark E.	Lawler
Thomas	Lawler
H. Harold	Laws
Audrey	Lawson
Scottie	Layman
Steve	Laymon
Mike	Lazzari
Carroll	Lee
Nancy	Lee
Cathy	Lee-Haight
Louie	Lembke
Don	Leonard
Helen M.	Leonard
John	Leonard
Donald	Lester
Pinky	Lewis
Sher	Lewis
Tim	Lillebo
Marv	Lindh
John	Lindner
Hal	Lindstrom
Dennis	Lipscomb
Allen	Liresly
Bill	Litherland
Darryl	Lloyd
Phil	Loe

Jim	Loeb
Chuck	Long
Hervey	Long
Matt	Longenbaugh
Larry	Longley
William K.	Longwell Jr.
Alfred	Lorenzen
C.P.	Love
Greg	Lovedahl
Patricia	Loveland
Merle	Lowden
Bill	Lowe
Dale	Luhman
Don	Lund
Mel	Lundstad
Scott	MacLeod
Rob	MacWhorter
Lorina R.	Madsen
David A.	Malsch, P.E.
Mario	Mamone
John J.	Mangan
H. Alvin	Manring
Nancy	Marconi-Wells
Mrs. Guy C.	Marcot
Edward	Margeson
Dennis E.	Marine
Craig	Markham
Seth	Marks
David	Marshall
Jed	Marshall
Louise	Marshall
Steve	Marspen
Gary	Martin
James	Martin
Jerry	Mason
Lawrence C.	Mason
Mary	Mason
Billie	Matteson
Bob	Maupin
James	Maxwell
Milt	Mayberry
Betty	Mayfield
Russell	Maynear
W E	McAleny
Michael	McAllister
Billie	McArthur
Don	McCall
Pat	McCauley
G. R.	McClarren
Bill O.	McClellan
Gin	McCollum
Thom	McConathy
Diana	McConkey
Grant	McConnel
William	McConochie
Judith	McCracken
Ernest	McDonald
Michael R.	McFeeley
Chuck	McGinnis
James	McGugin
Robert	McGuire
Jerry	McKague
Richard	McKinney
Robert	McLachlan
E.A.	McLarney
William	McLaughlin
Glen	McMahan
James	McMahan
Neil	McMahan Jr.
Andrew	McMillan
Bill	McMillan
Joan	McNab
Stephen	McNair Bell
Charles	McTee
Vaughn	Mead
Vivian	Mead
Neal	Mettler
Sonny	Mettler
Bill & Diane	Meyer
Bruno	Meyer
Diane	Meyer
Charles	Middleton
Howard	Millan
H.W.	Miller
Lee	Miller
Pat	Miller
Roy	Miller
Sharon	Miller
Archie	Mills
Jess	Minium
Mark	Minnis
Richard	Misner
Curtin	Mitchell
Ray	Moffatt
Bill	Moffet
Shawn	Mohoric
Dan	Monaghan
Carol	Monohon
Mel & Kay	Moodenbaugh
Frank	Moore
Spencer	Moore
Walter	Morat
Jack	Morby
John	Morgan
Mark	Morgans
Frank	Morrell

Roy H.	Morrill
Don	Morris
Eddie	Morris
Steve	Morris
Lenoard	Mowrey
Rob	Mrowka
Cecil	Mullins
Willis	Mullins
Gary	Mundinger
Quinn	Murk
Lucy	Murr
Dale	Murray
Wesley	Murray
J.	Music
Vic	Musselman
Justine F.	Nagel
Lee	Nance
Bruce	Neal
Bruce	Nelson
Cynthia	Nelson
David	Nelson
Howard	Nelson
John	Nelson
John & Mary	Nelson
Dennis	Neuzil
Robert G.	New
William	Newby
Irving	Newhouse
Tom	Newton
Thomas	Nickerson
James	Nielson
Krist	Niemcziek
William O.	Noble
Stephen	Nofield
Garry	Noot
Carol L.	Normond
Lisa	Norris
P.J.	Oberlander
Faye	Ogilvie
Dr. Ronald	Oliveira
James	Olsen
Vincent	Olson
R. Marriner	Orum
Joseph	Ozbolt
Mary	Paetzel
Jennifer	Paine
Allen C.	Parker
Ken	Parkin
Donald	Parks
Jean	Patterson
Mrs. Cecil	Paul
Paul C.	Paulsen
F. Scott	Payne
Edward	Pearson
Donald	Pederson
Ruth	Perkins
Marie	Peronne
Joe	Pesek
Donald	Peters
Beth	Peterson
Del	Peterson
Susan	Peterson
William	Peterson
Al	Pettey
Frances	Philipek
Brad	Phillips
Helen	Planeto
Joanne	Polayes
Rick	Posekany
Bob	Powne
Donald	Presley
Pegastian	Press
Frank	Price, Jr.
Jeff	Prime
Joel	Pritchard
Michael	Prouty
David	Publicover
W. Wm.	Puustinen
Charlie	Rains
Len	Ramp
Steve	Rankin
Katharine	Redmond
John	Reed
Gordon	Reinhart
Troy	Reinhart
Cynthia	Rezabek
H. D.	Rhodes
Avadna	Rickards
R. F.	Rieman
Bill	Rines
A.	Ringel
Ann	Risvold
Scott	Roberge
Dale	Roberts
Frank	Roberts
Gary	Roberts
Ed	Robertson
Charley	Robinson
Roxanne	Robison
Terry	Roelofs
Jim and Jean	Rogers
H. D.	Roman
K.	Rose
Joe	Ross
James	Ruble, Jr.
Shirley	Rugg

Jim	Running
Tim	Rymer
J.	Sanchez
Robert	Sandelin
John	Sargent
Fred	Sawyer
Michelle	Saxton
Rob	Schantz
Oscar	Scherrer
Suzi P.	Schlapfer
Joseph	Schott
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